AGARD

ADVISORY GROUP FOR AEROSPACE RESEARCH & DEVELOPMENT

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The Organisation and Functions of Documentation and Information Centres in Defence and Aerospace Environments

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THE ORGANISATION AND FUNCTIONS OF DOCUMENTATION AND INFORMATION CENTRES IN DEFENCE AND AEROSPACE ENVIRONMENTS

Copies of papers presented at the Technical Information Panel Specialists' Meeting held at the War Museum, Athens, Greece, 19–20 October 1988.

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- Providing scientific and technical advice and assistance to the Military Committee in the field of aerospace research and development (with particular regard to its military application);
- Continuously stimulating advances in the aerospace sciences relevant to strengthening the common defence posture;
- Improving the co-operation among member nations in aerospace research and development;
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THEME

There is general recognition of the value of and the need for documentation centres to support defence and aerospace organisation. Policy, organisation and management of documentation centres must be coordinated to provide consistency, permit interaction and prevent unnecessary duplication amongst such centres. The meeting brought together those responsible in the information field, created an awareness of new technology and methods applicable to the management of information services and promoted standardisation and consistency throughout information programmes.

The programme first presented an overview of the information scene in Greece and the problems faced there. Later sessions dealt with issues related to data acquisition and handling, methods to ascertain user requirements and to foster an awarenesss of available services, the problems of data security, and future trends in information handling.

Poster presentations, between the meeting sessions, gave the participants an overview of the organisation and function of various NATO nation Documentation and Information Centres, to show how the principles outlined during the meeting were being put into practice elsewhere.

* * *

Les avantages des centres de documentation et le besoin qui en existe en tant que support aux organismes de défense nationale et de recherche dans le domaine de l'aérospatial sont universellement reconnus. Il faut coordonner la politique, l'organisation et la gestion des centres de documentation afin d'assurer la cohérence, de permettre l'interaction nécessaire et d'éviter les doubles emplois inutiles. La conférence a réuni les différents responsables dans le domaine de l'information, afin de les sensibiliser aux nouvelles technologies et aux nouvelles méthodes applicables à la gestion des services d'information, et de promouvoir la normalisation et la cohérence tout au long des programmes d'information.

Le programme de la réunion présenta en premier lieu un tour d'horizon des activités dans le domaine de l'information en Grèce et les problèmes rencontrés. Les séances ultérieures traitèrent des questions relatives à la saisie et le traitement des données, le méthodes à employer afin de déterminer les besoins des utilisateurs, tout en les sensibilisant aux services disponibles, aux problèmes de la sécurité des données, et les perspectives d'avenir en traitement de l'information.

Des expositions d'affiches furent organisées entre les séances, pour donner aux participants un aperçu de l'organisation et des fonctions des centres d'information et de documentation des pays membres de l'OTAN, en expliquant la façon dont les principes abordés lors de la réunion sont mis en oeuvre ailleurs.

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THE OBJECTIVES AND ROLE OF THE GREEK NATIONAL DOCUMENTATION CENTRE

by

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ABSTRACT

In this paper a brief overview of the Greek information scene is presented. The objectives and the role of the National Documentation Centre are outlined together with some of its activities which proved to function within such an information environment as well as plans for continuity.

INTRODUCTION

The Greek Information environment embodies some special characteristics that affect the whole circle of information handling. Most important and unique of those is the Greek Language since it asks for a special character set. This characteristic coupled with the small size of the Greek information market results in the following implications:

(1) There are more than two hundred scientific journals published in Greece mainly by scientific associations and institutions. These journals cover a wide range of scientific fields and publish research papers by Greek scientists in Greek mainly on subjects of local interest. Very few of these journals are indexed and/or abstracted by the International Indexing and Abstracting Services. Papers published in the rest of the Greek scientific journals are virtually inaccessible.

(2) The lack of special software suitable to manage Greek-Latin text causes problems:
- Sorting of Greek words is usually out of the question
- Transliteration of Greek names is not included in the majority of the commercial software packages
- File organization for free text searching in texts written in Greek has to take into consideration a linguistic approach involving a morphological analysis of the Greek text
- Data entry of Greek text needs extra validation work.

(3) The small size of the Greek market raises the cost of foreign software and systems adoption according to the special needs.

These difficulties often result in the rejection of the application of computerized information handling.

LIBRARIES

There are 625 libraries spread all over Greece. The largest and most important of them, including the National Library, are located in and around the Athens area. The Academic and Research libraries contribute to about 15% of the total number. These are distributed around the country and they are mainly affiliated to universities and research centres. Most of the libraries are organized and run the 'old fashion way'. Cataloguing and indexing are processed manually and vital services such as circulation, reference, etc. are rare and poor.

Librarians have to be trained abroad, as library and information science disciplines have not yet been included in universities curriculum. Since 1978 departments of librarianship have been established only at the Higher Education level.

The main problems libraries are faced with are the following:

- reduction of budget
- lack of resources
- lack of library co-operation and networking (inter-library loan services).

As there is no library tradition as such, the state and/or the general administration is unaware, if not ignorant, of the libraries role in the academic and research institutions. Thus, support for library and library services is minimal or non-existent.

INFORMATION SERVICES

Problems one faces when set to organize and run a Public Information Service offering Greek Data Bases are mainly due to:

- delay in the implementation of the Greek public data network
- lack of data in machine readable form
- lack of special software suitable to manage Greek-Latin text.

The absence of a public data network has been tackled through 'rescue solutions' (use of leased lines, dial-up connections, etc.) In the near future the HELLASPAK network of the Organization of Telecommunication of Greece (OTE) will be available and will cover the needs in data communication.

The lack of data in machine readable form is tackled through the operations related with the production of databases. The lack of special software for bibliographic database management can be overcome with the development of such software or the adoption of specific well-known software packages according to the needs.

Essential components of such a software package should be:

- data entry (techniques for Greek text validation would be included)
- retrieval of data (free text searching would be included)
- network support (union files' management through network)
- exchange of data in machine readable form.

NATIONAL DOCUMENTATION CENTRE

In 1983 the Ministry of Research and Technology designated the National Documentation Centre to be the nucleus for a National Information System for Science and Technology.

NDC is part of the National Hellenic Research Foundation (Ministry of Industry, Energy and Technology/General Secretariat of Research and Technology), and works in close co-operation with the Greek Academic and Research Libraries and the Scientific Community.

Since Greece is an EEC country, NDC when formulating its objectives and giving priorities to its activities, has to take into account not only the present status and the prevailing conditions of the Greek Information Environment but also its perspectives as they are affected by any initiative or action undertaken by EEC/DG.XIII for the development of the European Information Market.

The activities of NDC can be outlined as follows:

NATIONAL DOCUMENTATION CENTRE AS INFORMATION PROVIDER

During the last five years the NDC has acted as the main information provider in Greece, covering the enormous scientific and technological information needs of the Greek scientific community. It has access to various host computers e.g.: DIMDI, ESA-IRS, DIALOG, PERGAMON-ORBIT-INFOLINE, TELESYSTEMES-QUESTEL, DATA STAR, ECHO.

NDC conducts online literature searches on request and provides bibliographic information to more than 7500 end users per year, who work for both the public and the private sectors, (National Health System, Ministries, Universities, Research Institutes, industries, enterprises etc.)

The cost of the online literature search and information retrieval is subsidised by the corresponding Ministries (Ministry of Education and Ministry of Health) through bilateral agreements with NDC. This way the end users get their bibliographic information free of charge and any bureaucratic or financial obstacles are overcome.

NDC works closely with UNEPs Coordinating Unit for the Mediterranean Action Plan and has provided online information access and retrieval services and has been instrumental in the compilation of a specialized data base on 'effects of climatic changes and related topics'.

NDC also acts as Document Supplier for any paper which is not available at the Greek Libraries.

Finally NDC provides consulting services on information and documentation systems and services to state and public institutions.

NATIONAL DOCUMENTATION CENTRE AS SOFTWARE AND SYSTEM DEVELOPER

In order to overcome problems related with the development of a Host computer centre, able to handle Greek literature and bibliographic data, NDC has designed and developed special software for online data base management. The major criterion of the whole design process has been the quick response time in the retrieval of data.

Major components of this software are the following:

- *Data entry* (create – update – delete records).

Most of the data stored in NDC's data bases are in text form and data entry procedures are based on a series of successive 'screens', to secure proper data validation. The software performs additional validation to ensure that all data entered are correct and valid and therefore retrievable.

Data entry may also take place on a 'local basis' (e.g.: at the data base Producers' sites) on magnetic medium. These data are stored on diskettes in the Common Communication Format (CCF) using software running on IBM PC XT or compatibles and is transferred to the files of the related data bases.

– *Retrieval*

The Common Command Language (CCL) was selected to be the retrieval language. The proper software (CCL's interpreter etc.) was developed by NDC. NDC also implemented as an extension the Greek 'translation' of CCL, the Greek Command Language (GCL).

Data bases designed and implemented by NDC are of both types, bibliographic and non-bibliographic (they are presented in the next paragraph). Data base design was based on standards as well as on studies of similar data bases available world wide.

A software for online document ordering among libraries which participate in the Union Catalogue of periodicals, was also developed in order to promote the interlibrary loan services.

NDC has also developed a comprehensive software package for microcomputers to be used for book-in-hand cataloguing by librarians. This software is offered to libraries free of charge and provides a prime opportunity for future library networking based on a Union catalogue of books.

NATIONAL DOCUMENTATION CENTRE AS DATA BASE PRODUCER

One of the main tasks of NDC is to create, develop and maintain Greek data bases in areas important to the Greek Scientific Community.

Since data are not available in machine readable form, as was mentioned earlier, its starting policy is to gear the creation of union lists and files which are created in cooperation and collaboration with related organisations, Institutions or Scientific Associations. This way, the NDC in cooperation with the Greek scientific libraries created a public accessible online Union list of the holdings of scientific periodicals.

There is no union catalogue of books in Greece.

To meet specific needs NDC adds to that by producing databases on its own. Such is the case of the Greek Dissertation Index.

Data bases which have been produced or co-produced by NDC and are now available online, are:

(1) *Union Catalogue of Scientific Library Holdings* for serials containing holdings of 45 Academic and Research Libraries.

(2) *Greek Dissertation Index*, containing doctoral theses of Greek Universities since 1985.

(3) *Greek Innovations and Patents*, produced in cooperation with the Greek Patent Office, containing about 15000 Greek Patents.

(4) *BIBI* (Greek Medical Literature), produced in cooperation with the Association of Medical Studies, containing 7500 references.

(5) *URSA-DIS* (Regional Development and Planning Studies) co-produced with Patras University, containing about 2000 papers on regional planning and development concerning all Greek Regions.

(6) *Inventory of On-Going Research Projects*, is at the phase of data collection through a general survey of research activities in Greece.

(7) *Greek Engineering Literature* is produced in cooperation with the Technical Chamber of Greece and is in the phase of data entry.

(8) *GEOMINERAL* studies data base is produced in cooperation with the Institute of Geology and Mineral exploitation and is in the phase of data entry.

NATIONAL DOCUMENTATION CENTRE AS HOST COMPUTER

NDC aims at the development and establishment of all the necessary procedures to provide online user access to the above mentioned data bases.

The computer centre of NDC is organized as an open access host. To achieve this, NDC installed and supported the 'libraries network' and established public access to its data bases through:

(1) leased lines
(2) modem to modem communication
(3) via Helpak (concentrator of the Organization of Telecommunications of Greece). A 4800 bps line (X 25 protocol) has been installed connecting NDC's computer with the Helpak concentrator. So, NDC's computer centre is the first Host computer in Greece, accessible from any point in the country or abroad.

FUTURE ACTIVITIES OF NATIONAL DOCUMENTATION CENTRE

NDC's short range planning is:

(1) To develop and maintain an online data base containing the Greek Bibliography in collaboration with the National Library and the Publishers Association.

(2) To establish some international bibliographic data bases (e.g.: MEDLINE, NTIS) on NDC's computer and offer them online.

(3) To develop intelligent interfaces for online retrieval of Greek texts.

(4) To introduce new optical technologies in information storage (CD-ROM, WORM, etc.)

(5) To participate in the EEC initiatives for the European Information Market of 1992 and the cooperation of European Libraries.

THE STATUS OF DEFENCE INFORMATION PROGRAMS IN GREECE

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This Paper describes the present situation, problems, needs and benefits of a Documentation and Information Centre for the Hellenic National Defence.

It also describes the efforts which started in 1985 by the Hellenic Airforce for the creation of a pilot information program which was developed to satisfy its own needs.

The paper presents the problems encountered in the realization of this effort which seem to be common with those of other countries and are caused by the variety of objectives, the multitude of user groups, the wide spectrum of information topics and the relatively limited number of users. The problem of the language barrier is also mentioned in relation to the implementation of modern information systems.

The results of a study for the Hellenic National Defence Documentation and Information Centre are described. The importance of a coordinated and efficiently managed effort for the development, organisation and operation of such a centre is stressed. The impacts of state of the art high technology means and a gradual implementation strategy for a feasible solution is addressed.

1. INTRODUCTION

In this presentation I will describe the steps followed for the establishment of the information centre of the Hellenic Airforce and its function today. I will also try to present the situation which exists today on the Defence Information Programs and the efforts which have been made for the improvement of the services provided.

2. THE INFORMATION CENTRE OF THE HELLENIC AIRFORCE

The Hellenic Airforce was the first among the other Services to realize the need for the establishment of an Information Centre. The efforts started in 1980 with the purpose to provide support to the basic needs in all areas of activity.
A committee was appointed in order to establish the operational baselines of the centre. During 1982 and 1983 the committee visited a number of public agencies and educational institutions in order to be informed on the capabilities and weaknesses of other centres performing similar functions. In addition, the members of the committee visited the Documentation and Information Centre of the German Armed Forces and the Information Centre of the Royal Aircraft Establishment in the United Kingdom.

The result of the committee efforts was the development of a plan and the implementation of the first phase of it that provided for the establishment of a centre called "Scientific Library" which started its operation in October 1985.

The Functions of this Library are:

-Bibliographic search
The system provides the capability to communicate with the Greek National Documentation Centre of the Secretariat of Research and Technology in the Hellenic Ministry of Industry, Research and Technology. In addition, the system is connected on-line with a number of Data Bases and Data Banks through the EURONET network.

-Supply of Documents
The users can order copies of publications through the library which are usually provided in microfiche format.

-Creation of Scientific and Technical Data-Base
The collection of bibliographic records relating to the publications which exist in the various units and services of the Hellenic Airforce has almost been completed. These data are entered in a data base. This effort has not been completed yet mainly due to insufficient availability of equipment and standardisation problems relating to the data collected.

-Maintenance of a Central Publications File
A central file of all incoming copies and AGARD publications is maintained in the library.

The services of the library are provided free of charge to all users of the Centre which are all Airforce Units and all agencies related to the Airforce such as the Hellenic Aerospace Industry, the National Weather Broadcast, and the Hellenic Arms Industry.

3. THE PROVISION OF INFORMATION IN THE HELLENIC ARMED FORCES TODAY

Early in 1988 the Hellenic National Defence General Staff appointed a six-member Working Group by representatives of all the Services and the Defence Industry with the purpose to conduct a study for the establishment of a central Documentation and Information Centre for the Hellenic Armed Forces.

The working group examined the current situation and verified the need for the establishment of a National Defence Information and Documentation Centre.

The first task of the working group was to collect data about the existing situation in the provision of scientific information for the defence agencies and services. This task was carried out with completion of a questionnaire, and interviews.

The questionnaire was answered by 26 libraries that cover a large variety of subjects such as airforce materials, weapon systems, meteorology, medicine, informatics, training etc.

From the analysis of the collected data it was concluded that:

-Organisation
The organisation of all libraries is based on the manual system. Each one use its own operating procedures.

-Services provided
The largest part offer lending facilities, one third offers bibliographic search and one fifth offers information bulletins. Translation service is offered only by one library.

Service Provided	Percentage
Loans	82
Bibliographic search	27
Information Bulletins	18
Copies	22
Translation	4

-Users
The number of potential users for all the examined libraries is about 8000 with a minimum of 10 and a maximum of 2500.

-Mode of operation
One fifth of the libraries have computerized records and the capability to perform a search under various entries such as the authors name, title, subject and keywords. In one library there is the capability to communicate and perform on-line search in data-bases of other countries through the EURONET.

-Printed material
The number of available book titles is of the order of 72000 and of periodicals is about 880. 75 percent of the books as well as the vast majority of the periodicals is written in a foreign language. Classified material is about 6 percent.

-Classification and Cataloguing Rules and Procedures
One third of the libraries uses one of the internationally accepted classification systems such as the Dewey, Decimal or UDC. There are no common procedures followed.

-Personnel
Most of the personnel in the libraries does not have a relevant educational background.

-Expenditure
The annual expenditure for the acquisition of new titles and maintenance ranges from 50 thousand to 20 million drachmas. Half of the libraries spend less than 200 thousand drachmas and only one library spends more than one and a half million drachmas per year.

-Problems
The major problems reported are:

-the limited funds available
-the lack of equipment such as photocopiers, microfiche readers etc.
-the limited capability for bibliographic search
-the inadequacy of allocated space
-the lack of a common classification cataloguing and indexing system to facilitate cooperation with other libraries in Greece or abroad.

In view of the above mentioned findings it is clear that the provision of information services is insufficient and the way of operation can be largely improved. The system is mostly manual and has the following deficiencies:

-Lack of timely information
The users cannot get sufficient, accurate and up-to-date information

-Lack of coordination
There is no agency responsible for the coordination of the provision of information in the Armed Forces. As a result there is often duplication of the work of the limited personnel.

-Limited dissemination of available information
There is very limited announcement to the users about the availability of information useful to their work.

-Excessive time spent in search for information
The time spent to search for information is very long especially if the information is not available within the Armed Forces. One of the main reasons is that the users do not know where to search for and what is available about a particular subject.

-Difficulty in obtaining copies of publications
Quite often even though the existence of information is known, it is difficult to obtain it.

-Delays in obtaining information
Often there are significant delays in trying to get the information to the end user.

-Impact on the user
The result from the above mentioned deficiencies is

-the discouragement of the user in trying to get information and

-the low quality of the work since sometimes the user is not certain that he has reviewed all relevant information available.

In summary we can say that the lack of a common Information Policy has resulted in a number of small libraries and information centres without coordination or cooperation, with insufficient means which offer services which generally do not satisfy the user needs. This has discouraged the users to seek the required information in these centres.

The current situation makes imperative to develop and implement an Information Policy that will ensure the exploitation of the scientific and technical knowledge. It is a positive sign that for the first time efforts are being made by all three services of the armed forces, with the cooperation of the defence industry, to provide the solution to the problem by first establishing a National Defence Information and Documentation Centre.

4. NATIONAL DEFENCE INFORMATION AND DOCUMENTATION CENTRE.

4.1 Mission

To provide documentation and information services to all agencies and services under the Ministry of Defence.

4.2 Objectives

The centre will act as the central agency responsible for the management of the Documentation and Information within the National Defence.

It will develop an Information Policy Plan and it will be responsible for its implementation by assisting all agencies involved.

It will act as an umbrella for all existing libraries which will be upgraded to small satellite Documentation Centres around this central Documentation and Information Centre.

It will use available documentation to avoid costly duplication and it should avoid redundancy where possible. It will maintain a central registry of the available publications of all the satellite documentation centres.

Organisationally the centre will be established at the level of the Hellenic National Defence General Staff.

The user must spend less time to get the information so that it will have more time to read the information.

It is important that the centre uses all available means in order to gain the confidence of the users.

4.3 Functions and Tasks

4.3.1 Short term functions and tasks

It will be kept continually well informed about the facilities of general and specialized information and documentation sources in- and outside of Greece.

It will create and maintain a subject index common for all satellite documentation centres.

It will maintain a central Bibliographical Registry of books, reports, and periodicals in the Armed Forces. This function will be supported by computer. Terminals will be provided to selected satellite documentation centres and other agencies such as research centres etc.
The importance of the central registration of documents should not be underestimated. It is a vehicle for disclosure of primary information, very often hidden in unknown and inaccessible collections. To this purpose not only the satellite libraries but also the offices and other holders of reports should be obliged to enter their documentation.

From these terminals the users will be able to perform a bibliographical search.

The data base will be accessed by multiple ways based on keywords, author, subject etc.

It will allow the direct exchange of defence oriented documents between Documentation and Technical information centres of NATO nations.

It will be responsible for preparing annual catalogues of all available publications including location of the actual document.

It will evaluate available classification systems or thesauri, in the English language, and will select one for implementation. It will develop a corresponding system the in Greek language. Such systems are necessary for the effective disclosure of documentation and information.

It will establish common rules and procedures for all satellite documentation centres.

4.3.2 Longer term functions and tasks

It will develop measures for the evaluation of the effectiveness of the centre. These will be used to monitor continuously the effectiveness for the improvement of the operation and the services provided.

It will develop a plan for dealing with emergency situations such as in periods of tension and crises situation.

4.4 Products and Services provided

<u>Customer Information Service/Bibliographic searches</u>

Through the Documentation and information Centre one agency, satellite documentation centre or an individual user will be able to perform a bibliographic search using either the centre's data base or the hosts data bases.

<u>Document Loans</u>

Loan facility will be available to the users.

Document Delivery/Supply and copying services

Users will be able to order through the centre copies of articles, publications etc. Documents acquired from external sources will be kept as property of the centre and might be lent when required.
Facilities for making photocopies will be available on-site.

Subscription Services/ Announcement Bulletins/ Catalogues

Announcements bulletin will be prepared and disseminated systematically in order to keep the users informed about recently acquired documentation.
It will disseminate annual catalogue of available publications.

Support Services

It will provide expertise to the other documentation centres or any agency within the Armed Forces for all matters related to Documentation and Information.

Study space

This can be provided at a later stage.

4.5 Upgrade the libraries into small documentation and information centres

The existing libraries will continue to provide services to their users but their role will be upgraded by taking measures such as education of existing personnel, employment of new specialized personnel, adoption of a common classification system, procedures and rules.
However these centres will keep their autonomy in many aspects.

4.5.1 Selection of the type of new publications

Each satellite documentation centre will select the type of publications to acquire according to the needs of its users but always in cooperation and under the coordination of the Central Documentation agency.

4.5.2 Acquisition of new publications

Each documentation centre will be independent to determine the way of acquisition of new publications.

4.5.3 Cataloguing and classification rules

All cooperating satellite libraries/documentation centres will adopt a common cataloguing system. This requires training of the existing personnel and employment of new.

4.6 On-line connection to other data bases and documentation centres

This centre will be the only one in the Armed Forces to have on-line connection and access to other data bases in Greece and abroad. It will sign agreements with commercial data bases and it will develop relations with other similar documentation and information centres in NATO nations.
One of the major problems in the exchange of information is the characteristic difference of the Greek language and alphabet in comparison with the Latin based languages.

5. CONCLUSIONS

All attempts for the establishment of a comprehensive Documentation and Information Centre have ambitious short and long term objectives which cannot be implemented all at once. Indeed, if we consider the limited means, personnel and experience that can be made available

for the realization of the efforts we should keep our primary objectives to a realistic level.

To this regard the primary efforts should first be concentrated to the following:

-Establishment of a Documentation and Information Centre

-Reorganisation and upgrade of the existing libraries

-Manning of the libraries with specialized personnel

-Increase of the funds available to acquire new titles and upgrade of the equipment.

-Amalgamation of the decentralized documentation centres under one control. This seems the most feasible and economical solution.

However, the long term objective is the evolutionary development of a complete centre which will utilize the modern information technology in support of the National Defence.

REFERENCES

1. Hermanus R. (1986) Development of a Scientific and Technical Information centre for the Hellenic Air Force Training Command. Contract No. AGARD/OTAN/TIP/84/714.

2. AGARD (1980). Information Services: Their organisation, Control and Use. AGARD Conference Proceedings No. 294.

3. US DoD. Defence Technical Information Centre. (1987) NATO Scientific and Technical Information Service (NTIS): Functional Description.

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USER NEEDS AND HOW TO DETERMINE THEM

by

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SUMMARY

Without users libraries and information centres have no purpose. It is essential therefore that our customers and their needs are fully known and understood. But knowing and understanding our users must be essentially a process of two-way communication involving regular dialogue between us.

Libraries and information centres need to operate within clearly defined terms of reference which give authority to our activities and form the basis for the user dialogue. Once our customers know and understand us, why we exist and what we can offer them, they are better equipped to express their needs. Some of our 'customers' will have little or no requirement for our services and we must know and appreciate this fact. We must also understand that specifying and perceiving user needs is a complex subject requiring cognitive skills.

Numerous existing user studies of scientists and engineers which have attempted to characterise their subject user populations regretably serve to confirm more or less what we know already ourselves from observation. As information science practitioners or librarians it is not difficult for us to arrive at our own brief, perhaps simplistic, description of the types of people who make up our customer base. We can say therefore that in the aerospace defence field, library customers and information requesters are basically research scientists, engineers and designers, technicians and instrument and machine operators, with a sprinkling of administrative staff for good measure. In the UK, such people are employed in universities and polytechnics, government R&D establishments, research associations and industry, where the individual companies are often defence contractors. We know also from observation that the extent to which they avail themselves of our services decreases the further away from scientific research the requirements of their jobs take them. This is probably true the World over.

In a recent book, Knowing everything about nothing[1], J. Ziman examines scientific career structures in the UK, basing his findings on qualitative interviews with scientific research personnel in all types of R&D organisations. He observes that the UK has no national R&D system with standard employment practices, and only a minority of scientific graduates actually go into research and development work. Those that do often have to diversify or migrate from their degree discipline. R&D is carried out by people who might be commonly defined as professional researchers, where it is virtually impossible to distinguish between 'research' and 'technological development'. Both merge with design, testing and production into work activities normally associated with those of engineers. Ziman also points out that many people engaged in R&D were trained as engineers and continue to think of themselves as engineers. Thus it has become the norm, at least in terms of official statistics, to describe all people in R&D as QSEs 'Qualified Scientists and Engineers'.

Certainly the nature of scientific research in defence related fields has altered over the last 20 or so years, becoming more strategic or applied; orientated towards specific projects, designed to achieve solutions to problems within the rigid constraints of limited time and resources, so that the popular concept of the academic scientist, free to indulge in fundamental, creative research in his own chosen field, able to take as long as is necessary to achieve results, is a character from the past. Government R&D is no exception. To quote from the 1987 Annual Review of Government Funded R&D[2]:

> "The research and development work of the Ministry of Defence (MOD) has the overall objective of meeting the needs of the Armed Services for equipment and weapons in a timely and cost effective manner."
>
> "The research programme is aimed at sustaining an underlying basis of scientific and technological expertise on the basis of which support can be given to the selection, development, production and operation of weapon systems and equipment, and assessments can be made of the likely future evolution of the threat and options of countering it. It contains no element of basic curiosity driven research."

But are R&D scientists and engineers a single homogeneous group with identical information needs? To my knowledge, nobody has attempted to gauge any similar change in information requirements or information gathering behaviour over the last 20 or so years, which might support this apparent fusion between engineers and scientists in R&D. To do so might prove impossible because of the difficulty of comparing like with like. However, future studies of R&D employees ought perhaps to concentrate more on the projects people are engaged on, their participants' individual roles and the stages that have been reached, as significant factors in the information needs equation, rather than their educational qualifications or subjective self-classifications, so often the means of characterisation adopted in the past.

If we were starting out, let us say, to set up a brand new information centre and library service from scratch, or more likely, to be taking up a post for the first time in an existing library, we would need to prepare ourselves initially by acquiring and assimilating a sound knowledge of the organisation. Thus, before we can know and understand the individuals, we must first have a clear understanding of our employer and his business. What are the aims and objectives; what activities are carried out; who are the customers or clientelle; and so on. We must also know and appreciate the size and organisational structure, who does what and where; how many sites or locations do they work at; what specialist departments, divisions or groups exist. These facts can usually be discovered without much difficulty from in-house literature, such as brochures, annual reports, departmental research programmes, and reviews; and also current contract documents, if we can gain access to them, but it might be necessary to overcome inherent misconceptions that the library does not have a need to see all these types of document.

The next process is to meet and get to know the people, the individuals in the research teams, who will make up the majority of our customer base. Before we can achieve this it is essential we introduce ourselves, which means written and oral communication and, more importantly, personal visits. Who we visit obviously is governed by the size of the organisation and might be single individuals or groups of people, depending on the ratio between library staff and customers, but whichever, such visits have a twofold purpose: to present ourselves as approachable, friendly and knowledgeable people with services to offer; and to learn from them what they do and what, if anything, they expect from us. At this point we begin what ought to become a regular friendly dialogue between service and user. Our first call should be the first of many.

From personal experience, I would suggest that the soundest foundation on which to base this opening discussion is a carefully drawn up set of Terms of Reference, previously agreed with our organisation's management board. Terms of Reference give the information centre authority and credentials; demonstrate we are an established part of the organisation, constituted for its benefit. They also show we mean business.

Terms of Reference for a typical scientific and technological library service in support of R&D might be:

Purpose: to provide effective technical information and library services in support of the research, development, technical, engineering, management and support activities of the organisation.

Objectives: to acquire, collect, safeguard and put to effective use all documentary and non-printed media relevant to the current work of the organisation and its historical development;

to provide computer-based and other information dissemination services so that the organisation's staff may be kept currently aware of developments in all fields of interest and relevance to their official work;

to provide on request answers to specific enquiries, either by advising on documentary and other sources to be consulted, or by providing bibliographies and lists of relevant papers, or by providing specific documents on loan and for reference;

to provide on request a central document translation service, both from and into foreign languages, in support of the organisation's work;

to provide an environment conducive to research, study or scientific creativity in the context of the organisation's official work;

to monitor current techniques, methods, systems and equipment relevant to information collection and dissemination and information centre administration, with a view to their appropriateness and cost beneficial introduction to the organisation.

The above I suggest, written to avoid undue restriction and permit flexibility, could give any R&D establishment's library freedom to operate effective and efficient basic services. No doubt other types of activity could be added if required and in a formalized version would incorporate appropriate reporting structures, such as user groups, library liaison officers, or official library committees, for example.

Equipped with Terms of Reference we can commence designing and implementing our information and library service to fit within it, but more necessarily, to meet our user's expectations, hopes and aspirations for that service. This applies equally to the situation where a service has not previously been operating or to where we intend reappraisal and redirection for an existing service.

The type of service we implement should ideally be based on our customers' perception of their needs but traditionally, following sound previous practice, is likely to give access to some or all of the following sources:

Technical reports
Monographs
Textbooks
Treatises
Pamphlets
Theses
Official publications, bills, statutes
Regulations
Standards, specifications, codes of practice
Handbooks, manuals, databooks
Encylopaedias
Dictionaries, glossaries, thesauri
Atlases, gazeteers, maps, plans
Yearbooks, almanacs, annuals
Biographical works
Preprints, reprints
Directories, buyers guides
Trade literature
Patents
Company reports and accounts
Statistical compendia
Conference proceedings
Registers of research
Expertise indexes
Guides to information resources
Guides to special collections
Periodicals (trade, learned, popular)
Newspapers (national, local)
Serials
Current awareness media
Contents sources
Abstracts, indexes
Reviews
Bibliographical tools
Guides to literature
Periodicals lists
Citation indexes
Library files and indexes
Catalogues
Databases (in-house, external)
Video tex, viewdata
Films, videos, audio tapes, disks
Photographs, prints
Drawings (technical, illustrative).

All the above sources, listed at random, supply varied forms and types of information, either directly by themselves or indirectly by leading us to where sought information can be found. Each has its place in a typical aerospace R&D establishment library therefore, and should be provided with the deliberate aim of meeting readily identifiable customer requirements. These requirements can be expressed by users either as continuing, personal or group interests, where regular acquisition, circulation and notification of current literature serves to keep the customer up to date, or as one-off enquiries for specific information or data, where the reactive information officer is tasked with finding the answers from the many sources and elsewhere.

As you will all know this is simply the beginning. To buy in the literature, establish subscriptions and exchanges, sign up with the databases, set up current awareness and SDI services, establish enquiry bureaux, are all passive activities, which if given a reasonable amount of publicity and, we hope, the help of personal recommendation, should attract the customers. But not all the people in the organisation have a need for this type of service.

Some work activities in an R&D organisation require little or no support from agencies outside their work place, where personal retention copies of handbooks, procedural manuals, office instructions, and the like, provide all the answers to day to day problems as they arise. At trials sites and ranges, for example, engineers and scientists routinely monitor equipment and machines, collecting and analysing data and images to predetermined schedules or programs, and require only that the appropriate operating and servicing manuals should be at their finger tips and not at some central library location which might be far removed from their installation or observation post.

Administrative staff tend also to behave according to established rules, protocols, in-house practices and set procedures, which rarely require them to look beyond their own offices or departments for advice, information or inspiration in their work.

Provided we are confident that these people are aware of our services through regular dialogue and publicity and we acknowledge their needs are limited and occasional, we ought not to worry over much. But when normally high-use groups, the R&D project directors and team leaders, ignore or under use our services and facilities, despite pro-active, even aggressive marketing, it should worry us. We need to understand why.

As resource managers we should be concerned that the provision of information services, paid for by the organisation at some considerable cost, for the working benefit of the employees, if substantially underused, might constitute profligate squander of the organisation's money. Clearly we should discover if, for example, our potential customers choose or prefer, for whatever reason, to seek solutions to their information problems from alternative external sources, such as the library of their professional association, especially if the same information is already or could be supplied by ourselves. We certainly need to know what they sought and what they hoped to achieve.

But more than that, we might be exposing an area of significant inefficiency. Under use of in-house facilities in such circumstances is compounded by the waste of the user's valuable time and energy in seeking help from outside; itself paralleled by a similar wastage at the other organisation's library in response to his requests.

It is always possible that non-use or under use of the library's resources arises from the researchers' lack of faith in the library's competence to help them, possibly but not necessarily born of bitter past experience. It also is conceivable that some have a positive dislike of libraries and librarians, a phobia almost, preferring instead either to take confidence from their own professional expertise and ability to solve their own problems, or to seek help as and when necessary from colleagues and follow researchers nearby.

In a recent study of non-users of information services[3] the author identifies a non-user syndrome caused by what he calls *information shock* or the psychological barrier. He alleges that however cleverly we attempt to disguise that awkward question, *why don't you use information services?* "Ego-defensive responses hide laziness, insecurity, ignorance and all manner of hang-ups" which are the true reasons behind their apparent apathy towards us.

To overcome these difficulties can hardly be a simple task, but were we to be in the business of selling our services then it would behove us to get to grips with the non-user problem, to develop better marketing strategies for maximum user appeal, especially if a competitor were eating up our market. At the same time, of course, we would have to be mindful not to create a demand we could not satisfy. If we make tempting offers we must deliver the goods.

Where we come closest to the heart of determining our users' needs is in the role of enquiry intermediary, acting as an interface between the customer and the information he requires by responding to specific requests. In December 1938, Edith Ditmas, the General Secretary of Aslib, writing in Aslib Information on the subject of answering enquiries said:

> "... the specialist invariably tends to think in the first instance along lines familiar to his specialist experience[4].

A statement, I expect you are thinking, as true then as it is today. Our job as intermediaries is no simpler now than it was half a century ago, except that we are some way nearer to understanding those mental processes which go on in the minds of enquirers which eventually induce them to pick up the phone or walk into the library in the hope of solving their problems.

Twenty years ago R.S. Taylor, in a seminal paper on cognitive librarianship demonstrated the need to examine in detail the development of a user's problem in his mind. He broke this development down into four distinct stages:

(1) The actual, but unexpressed need;

(2) The conscious need;

(3) The formalized need;

(4) The compromised need.

Stage 2 is the stage where he realizes he has a need; stage 3 occurs when he attempts to define his need and stage 4 is when he actually asks for something to satisfy his need. The task of the intermediary is to regress backwards through stage 3, hopefully reaching stage 2, by way of interrogative interview. A point of Taylor's paper was to demonstrate that the intermediary, or enquiries librarian, in order to be fully effective in this role must develop cognitive as well as communicative skills, and to recognise that enquirers ask ambiguous and non-straightforward questions. Our own experience confirms this. However, when a customer approaches an information centre or library asking to borrow a copy of a specified NASA report, for example, we usually supply a copy and never stop to question why it was asked for, or what the requester intended to use it for, or what was expected to be found in it. If the document cannot be supplied we might offer an alternative if we think it might contain similar or related information, but we largely assume they know what they want and leave it at that. Similarly, with apparently simple subject enquiries of the, *have you any books/reports etc on...?* type, more often than not, in the live situation, our reaction is to take enquirers to the available documents and allow them to search or browse for themselves and hope they will eventually find what they are looking for. Under the all too familiar constraints of staff shortages and limited time available, this could be the most expedient approach. Obviously also, were we to interrogate customers with a barrage of questions when they merely ask for a specific report would be ridiculous. Furthermore, it would probably act as a deterrent from their ever using our services again. But if a user-friendly dialogue has already been established with the customer, through regular face to face contact, founded on more than the requirements of demand and supply; where the library enquiries staff are closely involved with customers' current projects and work activities, interrogation relating to the actual need for particular documents might not be inappropriate, would not result in driving our customers away, and, I am convinced, could help develop a firm base for determining their other special needs.

That users find difficulty in formulating, then expressing, precisely their information needs must to a certain extent be conditioned by their understanding of the processes of information transfer and their awareness of the interactions between the many available source . For this we must blame our education systems. It is common nowadays for UK university and college students to be given guided tours of their faculty or school libraries, where the information facilities are fully explained to them, albeit with a strong emphasis on self-help. However, it is rare for subject-based courses to include as part of the syllabus detailed tuition on the databases and myriad other sources which relate to their course subjects and to encourage the type of lateral thinking that we have to acquire and practice to be effective intermediaries. I believe the teaching of subject-based information resource literacy would at least equip the eventual researcher with a view of the World in some respects resembling our own and would I suggest make their task of interpreting their information needs that little easier.

In the meantime we are caught in the dilemma of having to determine our users' needs and respond to them, when cognitive research tells us they have difficulty in sorting out what it is they really need themselves, where it is often necessary to redirect their thoughts away from the preconceived and preconditioned routes they set off on initially.

Traditional information retrieval methodology assumes that information needs can be directly and exactly matched with verbal concepts as represented by titles, abstracts, keywords and texts, sufficient to produce adequate solutions to technical problems. Provided we have been able to define and express the information needs correctly in the first place the theory should hold good. However, a major goal of current information retrieval research is to develop direct end-user access to information retrieval systems, whereby naive and intermittent users can interact directly with the data bases or knowledge sources without needing recourse to a human intermediary; the system providing its own intermediary in the form of highly developed, user-friendly software. I recently carried out a short exercise to analyse from the documented enquiries handled by the RAE Main Library over a random 2-year period, the frequency of individuals requiring a full literature search. Two hundred and forty six detailed subject enquiries resulting in full on-line database searches had been dealt with, each one being directed by an intermediary. One hundred and forty nine (61%) were single-user searches, the remaining 97 (39%) consisting mostly (27%) of individuals who initiated searches between two and four times during the 2 years.

On this evidence the human intermediary serves a very important purpose, particularly in the absence, as we currently are, of both the common command language, which might obviate the user having to be fully conversant with the several separate command languagues and protocols involved, and any software specifically designed to alleviate difficulty in formulating complex requirements into search strategies. I believe therefore, that despite the proliferation of sophisticated personal computers and micros, self-dialling modems, full-text databases and knowledge-based, expert systems, we are still very far away from an environment where the user determines his needs for himself and bypasses the library as an information access medium. We may be moving in that direction but are still decades away from achieving it, especially in such a many-faceted, multi-disciplinary field as aerospace and defence. Not, I think because of any unspoken threat to our survival which inhibits us from perfecting the procedures, but our inability to design systems to overcome the inherent perception and cognition difficulties. Nonetheless, even before we became aware of these psychological barriers and had applied labels to them we lacked confidence. Assuming that we had based our services on stated objectives, mutually agreed between ourselves and our customers, founded on endorsed terms of reference, we returned again and again to the question of determining user needs. As a performance indicator, required for self-evaluation, we recognized determining and meeting user needs is a primary objective of any service, yet a lingering doubt remained to nag at our consciences. Perhaps we underachieve? And the reason we think this is founded on the knowledge that often and probably for as many as half our recognizable customer base:

> "The user is the practical engineer, the man or woman whose job it is to solve everyday problems in industry, and who is not interested in what the so-called information expert likes to call information. Which really isn't information at all, but only a reference to something which, with great luck, might contain an item of some information value."[6]

We have been well aware in AGARD for more than a decade that users of the information services we provide, as comprehensive and user-orientated as we can conceivably present them, need the technical content of the documents rather than the documents themselves: of even less immediate value or practicability is a bibliography or list of references. And the need is intensifying.

As defence research becomes more and more customer driven and contracts are written tighter, to save on time and manpower resources, the need to solve strategic and applied problems by the shortest possible routes will become increasingly paramount. Consequently the time available for researchers to sift through abstracts databases and lists of references will equally be reduced to such an extent that we information resource managers will need to revive our erstwhile interest in information analysis. Our libraries and information centres will of necessity have to become more project orientated and better prepared to analyse the literature on behalf of our customers in order to establish a new credibility. Information analysis centres, all the rage in the 1960s, with a few notable exceptions such as the Mass Spectrometry Data Centre, never really caught on in the UK. As government sponsored and funded centres of excellence they were always

destined to be short lived and to suggest that the present British Government should inject public money for a similar purpose now would be out of the question. Impetus of this kind would necessarily have to come from industry and the private sector.

In 1985 a unique private company was launched in the UK - Defence Technology Enterprises Ltd (DTE), a commercially aware, entrepreneurial company with specialist marketing expertise. Since then DTE has quickly established, with the full support and cooperation of the Ministry of Defence, a comprehensive infrastructure within the Ministry of Defence's major research and development establishments - including the RAE, specifically designed to identify exploitable technology and to obtain the exploitation rights for its associate member companies. From this unique position, locally based *ferrets* sniff out those ideas and inventions they believe have commercial potential, passing them on to the firms who can develop them. This method of technology transfer is only an information analysis centre in disguise, operating as it does as a commercial, defence contractor, sifting information from current R&D projects and the technical reports which describe them.

More recently, a proposal currently being investigated is the possibility of reconstituting the Ministry of Defence's major non-nuclear research establishments into a single agency, of which the RAE would become part. With this new commercial initiative, the implications for those establishments' libraries to become even more project centred and analytical in terms of information dissemination are enormously challenging. If the Ministry of Defence actively encourages cooperation with a private company to analyse and disseminate its own information for profit, will it be long before it recognizes that its own commercial defence research agency could profitably benefit from selected, analysed packages of external information being injected opportunely into its research projects and sub-contracted R&D? Whether this might also become a contractor task need not concern us here. What is important I think is that a new research agency, if it comes into being, could find itself at the centre of a revived information incentive for the UK aerospace defence industry as a whole.

This is not to imply that existing R&D libraries and information centres in the UK do not or are unable to satisfy the requirement to analyse the relevant literature on behalf of customers. Among the industrial companies it is a fairly common practice, where manpower permits, but as recession has bitten and the requirement to reduce staff numbers has inevitably pruned away the 'luxury'(?) of support staff our capacity to meet this requirement has been seriously impeded.

Up to this point I have emphasised the value and importance of collaborative discussion with our customers to foster mutual understanding as the key to interpreting their information needs. But, however well we develop the relationship it will also be desirable, from time to time, to conduct independent user surveys, to quantify certain aspects of their information seeking behaviour or to gauge their reaction to a new or proposed service perhaps. Interviews and controlled observation are well established methods of accumulating this kind of data and the questionnaire is the most common and popular among investigators, as the already vast user study literature amply testifies.

In 1987 the RAE Main Library carried out a questionnaire survey of its scientific, engineering, professional and administrative users and non-users. It was intended

(a) to quantify the requirements for the existing services;

(b) to determine how adequately the requirement for information services is being met·

(c) to gauge awareness of existing services among users and non-users;

(d) to establish reasons for alternative and non-use of the existing services.

A simple questionnaire was designed to elicit subjective answers, opinions and impressions to a small range of mostly multiple choice questions. It was assumed that non-users might automatically disregard the questionnaire because they would think it did not concern them, but 20 people responded, mostly to say their jobs did not require them to use the library. One individual openly admitted he was too lazy.

T.D. Wilson has demonstrated the dangers of attempting to apply the results of one survey to characterise the behaviour of another perhaps dissimilar group of people[7], therefore, recognizing that the RAE's particular investigation is potentially unique to itself, I will not describe the full results here. One interesting observation however, concerns user attitude to the translation service. Only 22% of the user population claimed to use this facility, which possibly reflects the overall reduction in subscriptions to foreign (non-English language) periodicals in recent years. Forty eight per cent stated that they did not need translation services. Who can tell how much they miss, but that is the subject of an altogether different investigation.

I apologise here and now to everyone who hoped and anticipated that I just might produce a magic, universally applicable formula for identifying and characterising user needs. I hope I have demonstrated that it can never be that simple. But all the while we keep talking to our customers, monitoring changes in their behaviour and interests, while at the same time attempting to understand the complexities of needs perception, through cognitive awareness, we get closer to constructing the elusive user model.

REFERENCES

1 Ziman, J. Knowing everything about nothing: specialization and change in scientific careers. Cambridge University Press (1987) (ISBN 0 521 32385 1)

2 Cabinet Office. Annual review of government funded R&D 1987. Her Majesty's Stationery Office (1987) (SBN 0 11 513988 5)

3 Lea, G. Non-users of information services. Graham Lea and Partners (1987) (prospectus only)

4 Ditmas, E. Information ad lib by Aslib. Aslib Information, p 2-3, December 1938

5 Taylor, R.A. Question negotiation and information seeking in libraries. *College and Research Libraries*, 29, p 178-94 (1968)

6 Disch, A. The voice of the user - his information needs and requirements. In The problem of optimization of user benefit in scientific and technological information transfer. AGARD CP 179, paper 14 (1976)

7 Wilson, T.D. On user studies and information needs. *Journal of Documentation*, 37, p 3-15 (1981)

SOURCES OF INFORMATION

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ABSTRACT

The Scientific and Technical Documentation and Information Centre of the Armed Forces (TDCK) publishes monthly abstract bulletins concerning 15 subject areas, each bulletin containing 50-100 abstracts of max 200 words concerning scientific or technical reports and articles. This paper gives details about the information sources from which the reports and articles are selected and deals with external online or ondisc databases that are used. TDCK also publishes the monthly acquisitions list of the "Central Military Catalogue" (CMC) and coordinates the production of the automated cumulative catalogue of books. Details are given about the information sources (books, reference works and encyclopedia) that are present in major Defence libraries. Attention is also given to other information sources such as standards, manuals, loose leaf publications, videotapes and to information guides and registries.

1. INFORMATION FOR SCIENCE AND TECHNOLOGY

The Information Explosion: It is estimated that the 55,000 Science and Technology journals currently received by the British Library contain 6.5 million articles a year and that this number is still increasing by about 3% or 4% per annum. The British Library also receives 1 million patents and 140,000 reports per annum, some 40,000 books and 17,500 Conference Proceedings (1). So the vast majority of S & T publications appear in journals, of which at least 60% are in English. Because the British Library doesn't have all the literature from the whole world, the information explosion is still bigger than indicated by the British Library data.

The R & D process: Many S & T publications are related to Research and Development. For example, a R & D process starts with a Grant for a Research Project that will begin in 1988 and continue till 1990. In 1990 a final report will be published, and in 1992 one of the authors presents a paper during a Symposium. In 1993 the paper is rewritten and published as an article. Finally this leads to a chapter in a book in 1995. So the most recent information about R & D results can be found in reports. Many internal research reports are being written in Industry, but these are unavailable outside the company, the most recent information about industrial R & D being published in patent applications.

Ongoing Research: Information about ongoing research is given in the Dutch publication "Titels van sociaal-wetenschappelijk onderzoek" of the Social Sciences Documentation Centre (SWIDOC), which also gives information about planned dissertations. Information about social sciences research projects and about other research projects of universities is stored in the CILO database of the Netherlands Bureau for Research Information (NBOI). As the EEC has funds for European research programs such as Esprit and Race, information about these programs is regularly published in annual reports. A SDC1 database concerning these research projects is available on the EEC Echo hostcomputer.

Information about ongoing government research in the US can be found in the Federal Research in Progress database on Dialog. This database may, in 1989, already contain information about a research project that started in 1988. Sometimes the title of the final report differs slightly from the title of the research project. Information about the final report will be given in 1991, when an abstract is published in an abstract journal. Sometimes the title in the abstract journal is standardized and differs from the title on the report.

A distinction is made between primary publications such as reports, journals or books and secondary publications such as abstract journals or databases, that contain information about the primary publications. An overview of primary publications and secondary publications is given in Table 1.

2. MILITARY TECHNOLOGY TRANSFER

Positive or beneficial technology transfer supports useful application of technology. Effective technology transfer will become increasingly important in military developments if research, development, test and evaluation (RDTE) program funding is reduced. Also, technology transfer from defence and other government R & D programs to non-defence industries may enhance the ability of a country to compete in international commerce (2).

To enhance Army technology transfer in the US, several programs have been combined under the Technology Transfer Division of the US Army Laboratory Command at Adelphi, MD. These programs are:

- the Scientific and Technical Information Program (AR 70—45)
- the Independent R & D Technical Evaluation Program (AR 70—74)
- the Information for Industry Program (AR 70—35)
- the Domestic Technology Transfer Program (AR 70—57)

All these US programs are supported by the DTIC databases:

- *R & D Program Planning* (R & D projects)
- Work Unit Information System (projects underway)
- Technical Reports
- Independent R & D (evaluations of IR & D programs of contractors)

The Small Business Innovation Research Program (SBIR) requires agencies to set aside a portion of their R & D awards for small businesses with strong scientific and technical competence, wanting to do R & D work with the government. This program is highlighted in the "Small Business Guide to Federal R & D Funding Opportunities".

In countries where procurement of military equipment preferably is committed by the national industry, we can observe an increasing need for national defence research, development, test and evaluation activities and consequently a need for relevant and current documentation and information. Because Greece devotes 7% of its GNP to defence and because Hellenic Aerospace Industry (HAI), Hellenic Arms Industry, Hellenic Vehicle Industry, Greek Powder and Cartridge Co., Elefsis Shipyards, Hellenic Shipyards and ALPHA SA are state-owned operations, technology transfer from defence to industry might be important for Greece.

Although a symposium about defence technology was recently organised in the Netherlands to enhance the contacts between Defence and Industry, TDCK has no special task in technology transfer.

3. INFORMATION SOURCES FOR TDCK PRODUCTS

The main products of TDCK are the abstract bulletins, the TDCK STAIRS database, literature searches in this database and document supply. 90% of the document supply goes to Defence personnel, 5% to laboratories for Defence research and 5% to Government or Industry. The needs of the Defence organisation prevail, so the information sources for TDCK products are fitted to the tasks of the Dutch Defence organisation and to the needs of the Defence users. This means that patents are a minor information source for TDCK, although they are indispensable for industry. TDCK does not deal with juridical information because this is already being done by the Bureau of Juridical Affairs. TDCK does not maintain online databases concerning R & D projects or projects underway, because the number of defence research projects in the Netherlands is limited and can be managed without an online database.

All the information sources that are used at TDCK will be described in the following paragraphs. At the end of this section a comparison will be made between TDCK and BL(STI) collections, showing the relative importance of each information source.

3.1 REPORTS

Each year TDCK publishes abstracts of some 2500 reports. 500 of these reports are received automatically and 2000 reports are selected from various abstract bulletins.

TDCK automatically receives reports concerning defence research from Dutch research institutes such as Institute of Perception (IZF-TNO), Physical and Electronical Laboratory (FEL-TNO), Prins Maurits Laboratory (PML-TNO), TNO-IWECO and National Aerospace Laboratory (NLR). TDCK also receives reports from the Clingendael Institute of Peace Research, the Commission for Environmental Impact Statements, the Maritime Research Institute Netherlands (MARIN), the Royal Meteorological Institute (KNMI) and the Royal Naval Academy (KIM). International defence research reports are received from NATO institutes such as Shape Technical Centre and SACLANT, and civil research reports from ESA and the Institute for Oceanographic Science (IOS).

1000 final reports are selected from the Government Reports Announcements (GRA/NTIS). 40% of the selected reports are already available because TDCK has an ADD service from DTIC and automatically receives microfiches of AD-reports in the fields of Military Sciences, Missiles and Ordnance. These ADD microfiches are received some six months after the publication date of the report. 30% of the selected reports can be ordered as microfiches in the Netherlands and are received some nine months after the publication date. The remaining 30% is ordered from NTIS through the office of the Dutch Military Attaché and received some 12 months after the publication date of the reports. 200 final reports are selected from the Scientific and Technical Aerospace Reports (STAR/NASA). 40% of the selected reports are already available because TDCK has a NASA microfiche service and automatically receives microfiches of NASA reports from fields 23—39, 53 and 54. The other reports are ordered in the Netherlands or from NASA.

100 reports and other publications are selected from the Monthly Catalog of the Government Printing Office (GPO). 40% of the selected reports are already available because TDCK automatically receives microfiches of DoD reports. The other reports are ordered from GPO through the office of the Dutch Military Attaché. Some SAE reports are selected from the SAMCAD abstract bulletin and ordered from Dutch automotive industries.

100 English defence reports are selected from the DRIC bulletins, as well as 200 Canadian defence reports from the DSIS bulletins. 50 German reports are selected from the FIZDOK bulletins, as well as 50 Swedish reports from the FOA bulletins. French or German reports are selected from the annual list of the Institut Franco-Allemand de Recherche, St Louis (ISL), but ONERA reports are selected from the STAR/NASA bulletin. Translated Russian literature published in JPRS reports is also selected from the STAR/NASA bulletin or from the GRA/NTIS bulletin.

When a report is published in 3 volumes, it may happen that volume 1 is published in GRA/NTIS, volume 2 in STAR/NASA and volume 3 in TAB/DTIC. Patents, Theses, Conference Proceedings and articles of over 20 pages are treated as reports at TDCK and will be dealt with below.

3.2 PATENTS

Each year TDCK publishes abstracts of less than 50 patents. Several patents are selected from the Dutch patents periodical "De Industriele Eigendom", but the majority are US government inventions/patent applications that are selected from GRA/NTIS. Some patents are ordered as a result of online searches in patent databases or in the Chemabs database.

3.3 THESES

Each year TDCK publishes abstracts of some 50 theses. Some Dutch theses are received automatically or selected from the list B of the Dutch National Bibliography, which contains titles of Dutch non-book material such as reports and theses. Dutch theses can also be selected from the SWIDOC bulletin "Titels van sociaal-wetenschappelijk onderzoek". US theses from the Naval Postgraduate School or the Air Force Institute of Technology are selected from the GRA/NTIS or STAR/NASA abstract bulletins. German theses from the University of the Bundeswehr are selected from the Forschungsberichte.

3.4 CONFERENCE PROCEEDINGS

Each year TDCK publishes some 100 abstracts of Conference Proceedings. Proceedings of AGARD Conferences are received automatically. Proceedings of IEEE Conferences are often received as a special number of an IEEE journal. Proceedings of Conferences of the Society for Optical Engineering (SPIE), such as the Mobile Robots Conference, are ordered in the USA through the Bureau of the Military Attaché. Many Proceedings are selected from GRA/NTIS or STAR/NASA, such as the Proceedings of the 19th JANNAF Combustion Meeting or Lecture Series of the von Kármán Institute of Fluid Dynamics, and ordered as AD microfiches in the Netherlands. When Air Force personnel go to a Conference, TDCK gets a copy of the permission to go from the Air Force Personnel Office. TDCK asks for the Proceedings and makes a copy.

3.5 CONFERENCE PAPERS

TDCK publishes some 200 abstracts of Conference papers each year. Many papers are selected from GRA/NTIS or STAR/NASA abstract bulletins, or selected during online searching in NTIS, NASA, MARNA or INSPEC databases. Papers selected from abstract bulletins are ordered as papers. When papers are selected during online searching, it is better to order the Proceedings, because the Proceedings can contain other relevant papers. And in many cases it's cheaper to ask for the Proceedings than ordering a copy of a paper. The Proceedings are requested through the Dutch Inter-Library Loan system, because the Library of the Technical University maintains a central catalogue of Conference Proceedings. When the Proceedings are unavailable in the Netherlands, English papers are ordered from the British Library Document Supply Centre (BLDSC) and French papers from CNRS.

3.6 SEMINARS

In recent years, seminars of 1—2 days have become very popular in the Netherlands. These seminars deal with new subjects, cost some 200$ per day and are presented to some 100 people. When Air Force personnel get permission to attend a seminar, TDCK gets a copy of the permission and can ask for the papers or proceedings that were received, to make a copy for TDCK.

3.7 JOURNALS

The libraries of the Dutch Navy, Army and Air Force each have a budget of 45.000$ — 120.000$ for the acquisition of journals. The central library of the Air Force has 5000 subscriptions but only 890 journal titles. All 1600 titles of current subscriptions of the Dutch Defence Libraries and Documentation Centres are alphabetically listed in the "Current Serials List" of the "Central Military Catalogue" (CMC).

TDCK receives some 900 titles and for 200 of them TDCK has a subscription (IEEE journals, Library journals etc.). The remaining 700 titles come from the Defence libraries. They first send the journal to TDCK, where relevant articles are selected, copied and indexed for the abstract journals. The journals then go back to the owner-library for circulation. Each year some 8000 abstracts of articles are published in15 TDCK abstract bulletins and each year some 56,000 copies of articles are ordered by the readers of the abstract bulletins. From each journal title at least three articles per annum should be selected for the

abstract bulletins. In case the statistics show that less than three articles per annum are selected from a journal and that less than three articles from that journal are ordered, TDCK doesn't continue the subscription or sends a message to the owner-library to stop sending the journal. The statistics can be made because each journal has a 3-letter code, which is a formatted field in the TDCK STAIRS database that can be used for sorting.

The statistics in Table 2 show that 50% of Dutch language articles ordered were selected from the abstract bulletin 'Economy and Management', and that computer journals are very popular ('Informatie', 'Computer World', 'Databus').

10% of the articles ordered were published in the abstract bulletin 'Tactics and Strategy' and were selected from "Dutch Defence journals" such as 'Militaire Spectator', 'Parade', 'Jason', 'Marineblad', 'Atlantisch Perspektief' and 'Transaktie'. The remaining 40% was ordered fom 13 other abstract bulletins. This might mean that a documentation centre that would like to store and retrieve information in the national language should start with articles concerning economy, management, computers, tactics and strategy. But in Greece the prevailing management style is that of an entrepreneurial father-figure with overall powers (3), who probably does not read much. The statistics in Table 3 show the popularity of English journals within the Air Force. When we consider each TDCK abstract bulletin we see that the percentage of articles coming from military journals is 90% for the abstract bulletin 'Armament' and 10% for the 'Physics and Reactor Technology' bulletin. We also see that some abstract bulletins have 600 subscriptions (Armament, Tactics and Strategy) and others have 100 subscriptions (Meteorology). So the statistics will always give low numbers for Meteorology. This doesn't mean that the Meteorology bulletin is unimportant. Weather conditions can have dramatic effects on conventional warfare, so Meteo officers need to know the best methods of weather forecasting. So statistics don't tell everything.

3.8 SECONDARY SOURCES

TDCK also selects journal articles from secondary sources: abstract bulletins of other Defence Documentation Centres, such as FIZDOK bulletins, abstract bulletins of other Dutch Ministries or Institutes such as the Excerpta Informatica bulletin and the MARNA bulletin, or from accession lists from UK libraries such as the MoD Library list of new books and articles.

Annual Indexes: Printed annual indexes of NTIS and NASA Reports Announcements, Excerpta Informatica abstract bulletins etc. can be used for simple questions, when 1 keyword is enough. They are also used for bibliographic verification of incomplete report data such as author, title or report number. Also are used the AGARD Guide to Aerospace and Defence Technical Report Series and the annual index on COM-fiche of the DTIC TAB or TRAC bulletin.

Document supply: articles selected from secondary sources are first ordered in the Netherlands (Library of Technical University Delft, Library of Royal Dutch Academy of Sciences, PTT, Maritime Information Centre, Library of Catholic University Brabant). German articles are ordered from FIZDOKbw, English articles from BLDSC and French articles from CNRS.

3.9 IN-HOUSE DATABASES

PC Databases (single user): TDCK is a member of the SAMCAD, a documentation cooperative concerning automotive engineering. Each member selects articles from 25 automotive journals and indexes the abstracts using the SAMCAD thesaurus. Each member has a personal computer and Inmagic software. Diskettes with the data entries of the members are merged, the merged diskette being used for the production of the SAMCAD abstract bulletin. Each member then receives a copy of the merged diskette and can use it for uploading the SAMCAD database on his own PC.

DefenseNet and USNI Military Database are PC-based end-user oriented information retrieval systems. In the DefenseNet system of Teldan, Israel, articles are selected from 70 Core Defense journals. The abstracts are indexed. Diskettes with abstracts are sent on a subscription basis and can be used for producing an abstract bulletin or for uploading a small database on a PC.

Mini/Mainframe Databases (multi-user): The TDCK STAIRS database is used for 800 questions that are received annually. 85% of the questions can be solved by searching this database using descriptors or compact-codes from the TDCK Thesaurus and sending a print with 20—100 abstracts. The database now contains some 85.000 abstracts and has an annual growth of 10.500 abstracts (8.000 articles and 2500 reports). The abstracts are also published in the TDCK abstract bulletins and each year the readers order some 56.000 copies of articles and 7.500 reports.

3.10 EXTERNAL DATABASES

Since 1977 online searching in databases has become very popular all over the world, and nowadays over 3000 databases are available to retrieve information about any kind of subject. Several databases each contain more than 1 million abstracts of articles, reports, patents, books and other publications. Very popular databases are NTIS, NASA and INSPEC.

Since 1984 TDCK has access to host computers such as ESA in Italy, Dialog in the USA, Datastar in Switzerland, FIZ-Technik in Germany, Echo in Luxembourg, Profile in the UK, EEC in Belgium, RCC, MARNA and KUB in the Netherlands. These host computers are used in case the TDCK STAIRS database does not contain enough information (less than five articles) concerning a very special question.

Databases we frequently use are:

NTIS (reports concerning defence research, AD numbers)
NASA (reports concerning aerospace research, N numbers)
INSPEC (articles and papers concerning electronics, physics)
Index Medicus/Medline, Psych Info, ABI/Inform (management)
Chemical Abstracts, MARNA (maritime information)
Pascal (European literature, multidisciplinary)

Less frequently used are:

PAIS, SCAD, Foreign Economic Literature, Financial Times, Defense Markets and Technology, Current Technology Index (CTI), DOMA, Oceanic, Molars (meteorology), Patent databases, Standards databases.

Each TDCK Information Specialist masters three databases, for instance MARNA, NTIS and Oceanic. This means that he is familiar with the keywords, classification codes and other peculiarities of his three databases. Many databases such as NTIS and INSPEC are available on several hosts. Sometimes the ESA hostcomputer is preferred because of the powerful ZOOM command, which gives a frequency listing of the keywords that were used for indexing documents concerning a certain subject. This enables you to start in the Pascal database with English keywords, zoom and find the French keywords which will retrieve more documents.

Sometimes the Questindex of ESA or the Database of databases of Dialog is used to see which databases are best suited for a certain question. Sometimes multiple databases are searched by clustersearching on ESA or onesearch on Dialog. After the online search the requester gets a print-out with relevant abstracts and then he chooses which articles, reports or papers he would like to receive. Document supply has already been described in the previous paragraph. Documents that have been received are being sent to the requester, but copies are also processed at TDCK to be indexed for publication in the abstract bulletins. Further information concerning online searching can be found in the articles of Mayes (4), Bar and Finkler (5), Maciejewski (6).

3.11 CD-ROM

You probably all know the 12 cm audio Compact Disc. The same disc can also be used for the storage of data or text. In that case the disc is used as a Read Only Memory and called CD-ROM. 1 disc can store an enormous amount of information, some 250.000 pages. A complete 25 volume encyclopedia can be put on 1 disc. All the manuals of a paperless submarine can be stored on 3 discs and the same thing may happen for F-16 technical orders.

A CD-ROM can also be used for the storage of databases. Because you don't need a telephone CD-ROM databases are very popular when telecommunication is bad. Because there are no online connect or telecommunication charges (unlimited use) and extensive help features are provided to enhance the searching process, a CD-ROM is an *ideal training medium* for online searching.

NTIS. Because 50% of the budget for online searching is used for searching the NTIS database, we decided to buy a Hitachi CD-ROM drive and a disc of the NTIS database. The Dialog Ondisc was chosen because this system has an Easy Menu option for untrained end-users as well as a Dialog Command option. The Easy Menu option is ideal for bibliographic verification of incomplete report data such as author, title or report number, so we did not continue the subscription of the annual index of the NTIS. The Command option has the same software as the online Dialog databases, so you don't need to modify and retype a search strategy when you want to go online too, you can implement the search strategy that was refined and proven on the CD-ROM. The Dialog NTIS Ondisc has quarterly updates, the current disc is 1984 — September 1988, so the CD-ROM gives access to some 260.000 NTIS reports.

ERIC. TDCK also bought an ERIC disc from OCLC. The disc does not have a menu option and its speed is very slow for free text searching with boolean operators. For example, searching for the controlled discriptor Computer-assisted-instruction takes 16 seconds, but free text searching for Computer aided instruction takes 4 minutes. This shows that a CD-ROM needs to have a good *thesaurus*, which is regularly updated with new terminology.

Medline. We are testing Medline on CD-ROM. We could not start the Silver Platter disc, but the EBSCO disc works good and has some nice things such as an online MesH thesaurus and an online ordering module for articles.

A product we would like to have is an annual DTIC CD-ROM.

Access software is a problem, because each CD-ROM supplier has his own software. We probably need *gateway software* when using discs from different firms such as OCLC, Silver Platter, Dialog.

Reference Works

A CD-ROM is a very good medium for rather static information such as dictionaries and encyclopedia. The following reference works are available on CD-ROM:

— Kirk Othmer Encyclopedia of Chemical Technologie, Wiley

- Encyclopedia of Polymer Science and Engineering, Wiley
- Harrap Multilingual dictionary (13 dictionaries)
- Termdok Multilingual Dictionary

Integrated Products

At this moment the majority of CD-ROM product are one-product discs, with five years of one online database on one disc. But some publishers sell integrated products such as:

- the Wilsondisc CD-ROM, having 19 specialized databases (Cumulative Book Index, Government Publications, Essay Index)
- the Cambridge Life Sciences Collection, with information from 18 abstract journals
- the Construction Criteria Base, with over 50,000 pages of guide specifications and standards used in construction
- McGraw Hill Concise Encyclopedia of Science and Technology + McGraw Hill Dictionary of Scientific and Technical Terms
- the ADONIS disc, giving the full text of 219 biomedical journals complete with index information, 50 discs each year

Retrieval software is becoming a problem because each CD-ROM publisher uses his own software. But the Wilsondisc has become so popular in the US that its software might become standard. More information about CD-ROM products is given in the CD-ROM Directory 1988 (7).

3.12 DOCUMENT DELIVERY

When several interesting reports and articles have been found in external databases, they are not always available the same day. Because we receive thousands of microfiches of NTIS and NASA reports through the ADD service of DTIC etc, we usually have 40% of the reports that are needed. The Automatic Delivery of Documents (ADD) means that we receive all US Defense reports concerning the DTIC codes 15 (military Engineering), 16 Missiles and 19 Ordnance *sheet 6* 30% of the needed reports can be ordered as a microfiche in the Netherlands and is received within 2 weeks. The remaining 30% has to be ordered from NTIS through the office of the Dutch Navy Attache and is received within 2—6 months. NASA reports can be ordered in Paris.

Articles are first ordered in the Netherlands. If papers or articles are not available in the Netherlands, German articles are ordered from Technische Informations Bibliothek Hannover, English language papers or articles from BLDSC and French articles from CNRS. For ordering papers or articles from BLDSC we have to write a letter describing all details to the office of the Military Attache in London. Sometimes we order documents online.

In case a report is urgently required, we might consider to use "How to get it, a guide to defense-related Information Resources". This popular reference tool is used in the USA to locate hard-to-find government information of particular interest to the Defense Community.

3.13 COMPARISON OF BL(STI) AND TDCK

Growth of collection at items per year	BL(STI)	TDCK	TDCK/BL(STI)	
reports	140,000	2,500	17.80	0/00
conference proceedings	17,500	100	6.0	
articles	6,500,000	8,000	1.2	
patents	1,000,000	50	0.05	

4. OTHER INFORMATION SOURCES

4.1 BOOKS

Abstracts of books are not included in the TDCK abstract bulletins, but TDCK publishes the monthly acquisitions list of the "Central Military Catalogue" (CMC) which shows the titles of new books of some 50 Defence libraries. TDCK also maintains the cumulative central catalogue, that was automated in 1984. Each year some 4000 entries of new books and 6000 entries of old books are included, so the automated CMC now holds 40,000 titles, probably the books that were bought since 1978. A typical major defence library has some 25,000 books and sends 5,000 books on loan per annum. Each year some 500 books are bought and now 5,000 books (20% of its collection) are in the automated CMC.

The CMC is a dictionary catalogue, having author, titleword and keyword in one alphabet. The CMC is not online, each library receives each month a cumulative printed catalogue of its collection and COM fiches of the complete cumulative CMC. The CMC has no thesaurus, each library can use its own Dutch keywords. When TDCK receives a question concerning a typical Dutch subject, such as "Kortverbandvrijwilligers" or "Afslanking", the CMC is used as an information source.

An online shared cataloguing system exists in the Netherlands: the Project Integrated Catalogue Automation (PICA), that started to operate in some University libraries in 1980. The National Bibliography "Brinkmann" is a result of the shared cataloguing, just as the "List B", the bibliography of reports and theses. The libraries of the Royal Military Academy (KMA) and the Royal Navy Academy (KIM) have access to the PICA system. It is a good information source when you need a book concerning Expert Systems, Artificial Intelligence or another subject that will be given in the title. PICA also runs the National Central Catalogue (NCC), which at this moment contains holdings of some 220,000 journals. Because the Central Catalogue of Periodicals was printed for the last time in 1983, some 80% of the Inter-library Loans for copies of articles in the Netherlands are processed in the NCC.

In the Dutch defence libraries many books are selected by the librarian from book reviews in journals or from catalogues of publishers. But in the smaller libraries an officer or library committee decides what the librarian has to order. Because the books that are used in the Aerospace Community generally have English titles, the Central Library of the Air Force uses Bowker's Books in Print to find out if a book exists and where it should be ordered.

4.2 REFERENCE BOOKS

The major Dutch defence libraries have reference works such as yearbooks, handbooks, dictionaries, encyclopedia and atlases.

They have Dutch encyclopedias such as Algemene Winkler Prins, Grote Nederlandse Larousse, Grote Winkler Prins, Oosthoek, Winkler Prins Medische Encyclopedie and Winkler Prins Technische Encyclopedie. Sometimes they have foreign encyclopedias too, such as Brockhaus Enzyklopedie, Encyclopaedia Britannica, Grand Larousse, the McGraw Hill Encyclopedia of Science and Techology.

Dictionaries of Dutch publishers are present and sometimes they have foreign dictionaries such as Wörterbuch Luft- und Raumfahrttechnik Russisch-Deutsch by Kotik, Multilingual Aeronautical Dictionary of AGARD, English-Greek Dictionary by Kykkotis, Dictionnaire technique illustré en six langues by ATPCN, Jane's Dictionary of military terms, International business dictionary in nine languages, Dictionnaire de l'aeronautique et de l'espace by Goursau, Chambers diccionario cientifico y technologico, Russian-English military dictionary by JTLS, Webster's New World dictionary of the American language, Concise Oxford dictionary of current English.

The Atlas van Nederland and the Times Atlas of the World are normally present. Sometimes they have the Atlas of the Second World War, the Britannica Atlas, Lloyd Atlas of Maritime History, Mair Deutsche Generalatlas, Stieler Grand Atlas de Geographie, Times Atlas of the Oceans, Times Atlas of World History or the University Atlas. The library of the Royal Navy Academy has a precious Blaeuw Atlas from 1650.

The following yearbooks can be present: Keesing Historisch Archief, Europa Yearbook, the Statesman Yearbook, Yearbook of International Organizations, Yearbook of the United Nations, Yearbook of World Affairs, RUSI Defence Yearbook, SIPRI Yearbook, Jahrbuch des Heeres, Jahrbuch der Wehrtechnik, Navy Yearbook.

Dutch directories can be available: State Almanac, Pyttersen Almanac (of Organisations), ABC of Commerce & Industry. Jane directories can be present too, such as Spaceflight Directory. Not available is the US Directory of Federal Laboratory and *Technology Resources, which includes descriptions of 90 Technical Information Centers.*

The Central library of the Dutch Air Force has the following Jane's handbooks: All the World's Aircraft, Aviation Review, Avionics, World Aircraft Recognition Handbook.

Other handbooks in the Central Library of the Air Force are:

- Scientific and Technical Books and Serials in Print, Bowker
- World Aerospace Profile, Sterling Publications, London
- French Aerospace Equipment, Groupe des Equipements GIFAS
- Airport Technology International, Sterling Publications
- Political Handbook of the World, McGraw-Hill Book Company
- The International Countermeasures Handbook, EW Communications

More information about Reference books can be found in the Book Review Index: Reference Books (8), Walford's Guide to Reference Material (9) and the Guide to Reference Books by Sheehy (10).

4.3 STANDARDS

Formerly TDCK had a central collection of standards, but this was decentralised, the library of the Army being responsible for Dutch standards and German standards for the Army. The Army library each year pays some 25,000$ for standards, which includes the cost of a subscription on Milspecs on microfilm (Information Handling Services). The Milspecs and indexes are not in the library; they are stored in the Army Standardization Dept. TDCK does not pay much attention to Standards in the abstract bulletins. Even NATO Stanags are not indexed. But AC/315 is planning a NATO Standardisation

Information Base (NSIB) which should contain information about Stanags and relevant civil standards. In case TDCK receives a question concerning Milspecs, the question is sent to the Army Milspec specialist. But when a standards specialist asks TDCK for information, TDCK can search in online databases such as "Standards and Specifications" on Dialog for Milspecs and US standards, and DITR on FIZ-Technik for German standards.

4.4 MANUALS

There is no central storage of manuals in the Dutch Defence Department. The Air Force is responsible for manuals that are used in the Air Force. These manuals are not present in the Central library of the Air Force, because the "Publications Supply Department" (APV) deals with all manuals of Rolls Royce, Dowty-Rotol, F-16 Technical Orders or other. (Technical Orders will be stored on optical disk in the future, CALS project) APV officers maintain the online PUB system which contains information about all the manuals that are used and about the addresses where the manual is used. The main purpose of the PUB system is distributing updates. Because the Air Force has an APV officer at each location, the APV officer acts as a sort of librarian when there is no library. So the APV officer circulates TDCK abstract bulletins and he also orders all the copies of TDCK articles for the personnel of a certain Air Force Base. Several APV officers have online access to the TDCK STAIRS database.

TDCK includes some abstracts of manuals in the TDCK abstract bulletins, because sometimes hardcopy manuals are received through the Netherlands Liaison Officer (NLO) at US Army TRADOC or through the International Exchange Bureau of the Dutch Royal Library. Test procedures are selected from GRA/NTIS (TOP's, ITOP's, MTP's). TDCK also includes some US Navy manuals (NAVSEA, NAVTRA etc).

TDCK has COM indexes of US Navy manuals, Army manuals (DA PAM 25—30) and of the PUB system which includes many US Air Force manuals. TDCK also has a copy of the index of manuals of the UK Navy. When a request concerning manuals is received, the request usually is sent to the foreign manuals officer of the Army or to the central APV office.

4.5 LOOSE LEAF PUBLICATIONS

Loose leaf publications are rather expensive books that are regularly updated, such as the 2300 page, 2-volume Scientific American MEDICINE systems, which costs US$ 245 per year, for 6—9 replacement chapters each month. AGARD and NASA have sponsored the loose leaf publication "Engineering Data Compendium, Human Perception and Performance" of the Harry G.Armstrong Aerospace Medical Research Laboratory (AAMRL).

Loose leaf publications are very popular in the Netherlands and social security regulations, administrative procedures and law guidelines are subjects that are treated. Loose leaf publications can be very expensive for libraries, because many managers think they need a personal copy.

The libraries of the Air Force, Army and Navy each pay some 25,000$—60,000$ for subscriptions on loose leaf publications.

The information contained in loose leaf publications is not properly indexed in abstract bulletins. Because loose leaf publications are expensive and updating them takes time, it's possible that loose leaf publications will be replaced by CD-ROM or WORM products. The Scientific American MEDICINE System already exists in a diskette version for IBM or Apple type PC. Should these products be available in the library?

4.6 DISTILLATES

A Swiss publisher, WEKA-Verlag in Zurich, publishes a new form of loose leaf publications for managers. In their publication "Die wichtigsten Bücher für das Management in Kürze" they give 6 distillates of famous management books, each 2 months for SFr 348 a year. Each distillate is an abstract of 8 pages so you don't need to read the book. This resembles the Readers Digest system.

4.7 VIDEO

Videotapes are becoming very popular as a medium for giving courses, presentations. If you can't go to Farnborough you can buy a videotape of this exhibition. Fusion Video sells video documents about the Falklands War or about Combat Helicopters. Defence Training Videos, edited by the Soviet Studies Research Centre of Sandhurst, are available from Jane's. The American Management Association (AMA) presents Management Briefings by Satellite Videoconferences, two hours by a panel of experts, with half an hour of live discussion nationwide, which can be downlinked on tape. The Dutch Army, Navy and Air Force already have many U-Matic tapes with courses and presentations concerning new weapons. The tapes of the Army are distributed by a Film officer who has a list of all titles of the Army. A complete list of all Video material of Navy, Army and Air Force will become available in 1988. A real central catalogue in which to search for a subject does not exist. Only the video material in the Mediatheek of the Royal Military Academy (KMA) is properly catalogued. The Central Library of the Air Force discusses the possibility of introducing video tapes in the library.

A Dutch database, Audio Visual Materials (AVM), is run by PICA.

4.8 AUDIO TAPES

Many managers don't have the time to read a book or to go to a seminar. So publishers such as Intermediair in the Netherlands make audio cassettes about decision making, planning, motivating, that you can play in a car, train or plane.

4.9 USER DATA PACKAGES

Sometimes it takes a lot of time to convince people that they should use the results of a research project. Knowledge from the laboratories must be taught to individuals. That's why the US Naval Facilities Engineering Command and the Naval Civil Engineering Laboratory designed the User Data Package. Instead of final reports the user gets texts that can be included in technical criteria and guide specifications plus an operational demonstration of the findings (11).

5. INFORMATION GUIDES

Although much information can be found online, it takes much time to evaluate the information that has been found. That's why it can be useful to look for bibliographies, information sources or information guides concerning a certain subject, because these guides normally give information that has already been evaluated.

Some examples are:

UNIDO Guides to Information Sources
No 6 Information Sources on Industrial Quality Control
Nr 36 Information Sources on Industrial Maintenance and Repair

GPO subject bibliographies of Assistant Public Printer (free)
SB Nr 51 Computers and data processing
SB-018 Aviation information and training materials

Library of Congress science tracer bulletins
TB 87— 9 Microcomputers
TB 87—12 Optical disk technology

Defense/Aerospace Information Sources Director
Ed. Joelle Marin. Potomac, MD: Phillips Publ. 1988

Selected ERIC bibliographies
Information Sources on: Microcomputers in libraries: Library administration

Information about information guides can be found in:

Information Sources in Science and Technology: a practical guide to traditional and online use
C.C.Parker, R.V.Turley
London: Butterworths

European Sources of Scientific and Technical Information, Longman Group Ltd

Secondary Research: Information Sources and Methods
D.W.Stewart
Applied Social Research Methods Series, Volume 4
Beverly Hills: Sage Publications, third printing 1987

5.1 INFORMATION ANALYSIS CENTERS

Information Analysis Centers were established in the mid-1940s in the USA by DoD to collect, analyse and store published and unpublished information on highly specialized technical areas. They also evaluate and create new authoritative state-of-the-art information such as 3-volume loose-leaf handbooks. An IAC may have a staff of 20—200 people, 50% having a Ph.D, M.Sc or B.Sc. 12 contractor-operated IACs are now administratively managed and funded by DLA and DTIC, 9 IACs are managed by other DoD activities. IACs exist for chemical warfare, chemical propulsion, guidance and control, high temperature materials, infrared, metal matrix composites, software, survivability etc. A new Crew Systems Ergonomic Information Analysis Center (CSERIAC) will be located at Wright-Patterson Air Force Base.

Support is primarily provided to DoD and DoD contractors. Access to other organizations and the private sector is provided to the extent practicable without impairment of service to DoD. Charges are assessed according to a pre-established fee structure or on the basis of costs incurred. Products and services offered are, on a need to know basis: Handbooks (Aerospace Structural Metals Handbook, Structural Alloys Handbook, Propulsion Manuals), Abstracts and Indexes, Newsletters, Technical Inquiry Service, Bibliographic Inquiry Service. Detailed information about IACs is given in (12).

6. REGISTRIES

Registries can be a valuable source of infomation because they receive and distribute many valuable documents such as NATO studies, reports of Dutch Working Groups etc. Many government registries are now being automated, the registries of the Dutch Department of Defence are using a modification of the STAIRS mainframe program. Dutch keywords are being used, but a systematic thesaurus does not yet exist. The Dutch NATO registries are not yet automated. You can only ask for a

document if you already know its title or number. So when you have heard of a NATO document about simulation for training, it will take a lot of time to locate it. One way is to contact the Defence Staff and ask which Dutch officer is a member of the relevant panel.

6.1 NSTIS

In 1985 the Technical Information Panel of AGARD established the NATO/AGARD Working Group-01 to evaluate the feasibility of a NATO Scientific and Technical Information Service (NSTIS). The functional description of the NSTIS suggests that the service should be situated in NATO Headquarters in Brussels, and suggests that the service must have the facilities to work directly with all parts of NATO and to share resources with the NATO nations. (13). The NSTIS should provide the basic services: demand searching of NSTIS databases and external databases, document ordering, and identifying STI-related resources. The NSTIS citation database will contain information about documents generated at NATO HQ: technical reports, technical documents, conference proceedings, concept papers, industrial studies, allied publications, Stanags. If the NSTIS comes into existence, it will be possible to find the details about the NATO document about simulation for training quite easily.

REFERENCES

1. *Information for science and technology.* M.B.Line. Open, vol.20 (May 1988) p166—171

2. *Military and Domestic Technology Transfer.* K.Bastress. Army Research, Development & Acquisition Bulletin, Jan—Feb 1988

3. *In search of an Effective Management Science Application in a Developing Country — The Case of Greece.* A.Sissouras. Omega Int. J. of Mgmt Sci., Vol.16, No.3, pp. 249—258, 1988

4. *The use of bibliographic databases in defence/military studies.* P.B.Mayes. Proceedings 5th International Online Information Meeting, London, December 1981, p267—271

5. *A multi-database multidisciplinary search approach for tomorrow's online.* J.Bar, M.Finkler. Proceedings 11th International Online Information Meeting, London, December 1987, p147—155.

6. *Mit Online-Datenbanken erweitert das Management sein Wissen.* P.G.Maciejewski. io Management Zeitschrift, vol 57, Juni 1988 p273—277

7. *The CD-ROM Directory 1988; The International Directory.* — 2nd Edition/Edited by Kate Churchill. — London: TFPL Publishing, 1987. — 498p. — ISBN 1-870889-07

8. *Book Review Index: Reference Books, 1965—1984.* Edited by Barbara Beach. Detroit: Gale Research Co. 1986, 700p. — ISBN 0-8103-2195-5

9. *Walford's guide to reference material*/ed. by A.J.Walford. — 4th. ed. — London: Library Association. — 3 vol. Vol.1: Science and technology/with the assistance of Anthony P.Harvey and H.Drubba. — 1980. — 679p. — ISBN 0-598-10131-7

10. *Guide to reference books*/Eugene P.Sheehy; with the assistance of Rita G.Keckeissen and Eileen McIlvaine. — 10th. ed. rev., expanded and updated version. — Chicago: American Library Association, 1986. — 1560p. — ISBN 0-8398-0390-8

11. *Technology Transfer; Making it easier.* M.E.Essoglou. The Military Engineer, Vol.80, No.519, 1988, p38—40

12. *Department of Defense Information Analysis Centers.* M.C.Rothschild. Special libraries, (Summer 1987) p162—169

13. *NATO Scientific and Technical Information Service (NSTIS).* Functional description, April 1987. Department of Defense, Defense Technical Information Service

table 1 SOURCES OF INFORMATION

Overview of R&D information

	Primary information					Secondary information	
Type	UNIV	GOVT	DEF.	IND.	PUBL	National	Internat.
Research in prog.	+	+	+			SWIDOC CILO	ESPRIT SDC1 FRIP
Report	+	annual final	+	+		List B	NTIS TAB DSIS DRIC
Patent	+	+	+	+++		Ind. Eig.	Derwent
Thesis	+++					List B	UMI
Conference		+	AGARD	+		Calendar	NASA
Seminar			+	+	++		
Video	+		+			AVM	
Journal article	+	+	+	+	+++	DOTA TACO	CTI FIZDOK Databases Teldan disk
Books					+++	Brinkman NCC	Books in prt Destillates OCLC
Handbooks					++		
Encyclopaedia					++		

Overview of NON R&D Information

	Primary information					Secondary information	
Type	UNIV	GOVT	DEF.	IND.	PUBL	National	International
Standards		++	+	+			Standardline
Manuals			+	+++		PUB syst	
Regulations							
Laws		++			++	PARAC	
Loose leaf					++		
Dictionaries					++		
Directories					++		
Atlases					++		

Table 2 POPULARITY OF DUTCH JOURNALS

This list is based on statistics. Column A deals with the number of copies of articles from a journal, ordered by users of TDCK services during 6 months. The next 3 columns show how many articles from that journal were selected, documented and published in the TDCK Abstract bulletins Economy and Management (EM), Tactics and Strategy (TS) and all other bulletins (Rest), during 30 months.

	Ordered from	Published by		
		EM	TS	Rest
1 Leidinggeven en Organiseren	665	.53	...	..1
2 Intermediair	600	65	85	54
3 Informatie	521	112		99
4 Computer World	296	14		25
5 Databus	284			50
6 Management & Organisatie	250	54		4
7 Militaire Spectator	242	36	66	22
8 Kantoor en Efficiency	239	68		24
9 Bedrijfskunde	209	34		3
10 Psychologie	198	2		66
11 Elseviers Magazine	158	8	25	7
12 Harvard Holland Review				
13 Economisch en sociaal tijdschrift	134	10		
14 PT/Werktuigbouw	125	11		79
15 PT/Elektrotechniek/Elektronica	125	1		83
16 Tijdschrift voor Inkoop en Logistiek	118	27		1
17 Internationale Spectator	112	25	60	
18 Parade	104	31	6	7
19 Gids voor Personeelsmanagement	99	69		1
20 Kijk	91		1	50
21 AG Report	85	16		1
22 Personeelsbeleid	81	48		1
23 Economisch Statistische Berichten	79	148		7
24 Financieel Economisch Magazine	79	40	1	9
25 Jason	76	3	23	
26 Electronica	75	2		82
27 Logos	74	6		5
28 Bestuur (Overheidskunde)	70	45	1	1
29 Marineblad	68	27	28	29
30 Maandblad Bedrijfsadministratie & Org.	67	18		
31 Bouwwereld	65	6		114
32 Transport en Opslag	64	31		66
33 Atlantisch Perspektief	61	2	45	1
34 Toegepaste wetenschappen TNO	58	1		28
35 Transaktie	57	5	29	1
36 Maandblad Accountancy & Bedrijfshuish.	56	39		2
37 Natuur en Techniek	54	1		104
38 de Ingenieur	53	12		62
39 het Ingenieursblad	53	17		34
40 Bestuurswetenschappen	52	20	1	

Table 3 POPULARITY OF ENGLISH AEROSPACE JOURNALS

	Journal Name	Number of copies ordered by Air Force	Number of copies ordered by Readers L	SUM
1	Military Technology	115	95	210
2	Air Force Magazine	46	114	160
3	Jane s Defence Weekly	55	73	128
4	Interavia	39	86	125
5	Flight International	35	84	119
6	International Defense Review	56	32	88
7	Defence	47	35	82
8	Defense Electronics	43	34	77
9	NATO's 16 Nations	38	33	71
10	Rotor + Wing International	18	48	66
11	Aerospace Engineering	19	44	63
12	Journal of Navigation	14	41	55
13	Aviation Week + Space Technology	23	30	53
14	Heracles	43	8	51
15	National Defense	13	32	45
16	Defense Attache	18	27	45
17	Quality Progress	43		43
18	Aircraft Engineering	09	30	39
19	Proceedings US Naval Institute	25	14	39
20	Machine Design	37	01	38
21	Navy International	15	20	35
22	Internal Auditor	33		33
23	Air Pictorial	9	20	29
24	Journal of Guidance + Control	11	14	25
25	Armada International	7	16	23
26	Spaceflight	9	11	20
27	Armed Forces	20		20
28	Aviation Space + Environm. Medicine	18	1	19
29	Computers and Operations Research	17		17
30	Aerospace America	4	13	17
31	Maritime Defence	4	13	17
32	Communications Engineering	16		16
33	Military Review	16		16
34	Signal	15		15
35	Management Decision	15		15
36	Advanced Management Journal	14		14
37	Long Range Planning	13		13
38	Journal of Systems Management	13		13

based on : 6 months requests
18 months abstract bulletins

Table 4 POPULARITY OF LANGUAGE

LANGUAGE	Abstracts Published	Articles Ordered
ENGLISH	65%	48%
DUTCH	18%	43,8%
GERMAN	16%	8%
FRENCH	1%	0,2%
TOTAL	100%	100%
Absolute	8.000	56.000

Table 5 TOP 10 ENGLISH AEROSPACE JOURNALS

	Indexed by Teldan
Military Technology	+
Air Force magazine	+
Jane's Defence Weekly	+
Interavia	+
Flight International	+
Defence	–
Defence Electronics	+
Nato's 16 Nations	+
Rotor and Wing International	–
Aerospace Engineering	–

STANDARDIZED BIBLIOGRAPHIC PROCESSING

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ABSTRACT

Because of an ever growing number of publications, and ever dwindling economic resources, those who work in the information community have always seen the need to share resources through standardization. Since the 1960's new computer technologies have made the sharing and exchange of bibliographic records feasible. Throughout this period, standards for descriptive cataloguing have been refined so that the records being exchanged will be compatible. Based on these standard machine readable records, both libraries and the abstracting/indexing communities have developed various formal exchange formats. This paper presents an overview of the development of standardized bibliographic processing from the first cataloguing rules through to computer exchange formats. The use of these standards by the Defence and Aerospace community is examined with particular emphasis on the treatment of technical reports.

INTRODUCTION

The requirement for standards dealing with information handling is generally obvious to members of the information community. This paper will offer a brief history of and some of the rationale for the development of standards within our industry. We will attempt to clarify the unwieldy situation which presently exists in the exchange of bibliographic material both internationally and nationally.

In recent years rapid technological change and the ensuing proliferation of new products and services has led to widespread demand for benchmarks of quality. Standardization has become a fact of life. We are witnessing an increase in the number of standards and standard controlling agencies with a corresponding number of confusing acronyms and initialisms. For example, in Canada the National Standards System (NSS) consists of a coordinating agency, the Standards Council of Canada (SCC) and five standards writing organizations (the Canadian Gas Association - CGSA, the Canadian General Standards Board - CGSB, the Canadian Standards Association - CSA, the Underwriters' Laboratories of Canada - ULC, and the Bureau de normalisation du Québec - BNQ). Also under the umbrella of the SCC are five certification organizations, thirty-four testing organizations and many others "concerned" with national standardization (Standards Council of Canada, 1987).

It has never seemed appropriate to question the value of standards. We all know that standards are designed for our common good. Technical standards save us from the frustrating and the expensive. As Sandra Paul illustrated with a poster published by the American National Standards Institute (ANSI), no one wants to have to purchase 6 different lightbulbs to find the one that fits their lamp socket. (Figure 1, Paul, 1984). Not only do standards save us time and money, many of them also protect us and ensure our safety. An example of a protective standard in Canada is one that details acceptable levels of air pollutants such as asbestos.

Figure 1. American National Standards Institute Poster

General Categories of Standards

Taking a look at technical standards, we find that they fall loosely into three categories: those that are developed because they lead to financial benefit; those that have safety or consumer protection implications; and finally those that set out a quality to be achieved which is valued and culturally appropriate. Of course the standards that have been most successful in the commercial world are in the first category, while standards providing protection seem to be successful usually only when coupled with government intervention (Paul, 1982). The third category of standards, and those with which most of us are familiar in the information industry, are qualitative in nature. These have the least chance of being universally and consistently implemented as they carry little concrete incentive other than the achievement of a common goal of quality service.

Standards in the Information Industry

It could be well argued that the information industry standards are more than qualitative in nature, but that is not at issue here. What we must recognize is the fact that we have been involved in standardization for many years, whether the incentive has been material or altruistic. In fact, the American National Standards Committee Z39 dealing with library, information science and related publishing areas has existed since 1939 and lists at present approximately 40 standards related to information processing of one type or another (Rush, 1982).

In twenty years the information industry has witnessed an "information explosion" and along with it an increased demand for higher quality service. Dian Cohen a prominent Canadian economist has stated that we are moving from a product oriented economy to an information oriented economy (Cohen, 1988). Librarians are faced with the dilemma of trying to provide greater service with static resources. They view standards as one means to achieving high quality useful service while minimizing costly repetition and inconsistency. This recent move to standardization is evident when we consider that most of the 40 standards produced by the American Z39 Committee have been produced since 1970 (Wood, 1982). Further, at present there are at least 20 information standards under development (Rush, 1982). Figure 2 illustrates this trend towards increased standardization clearly.

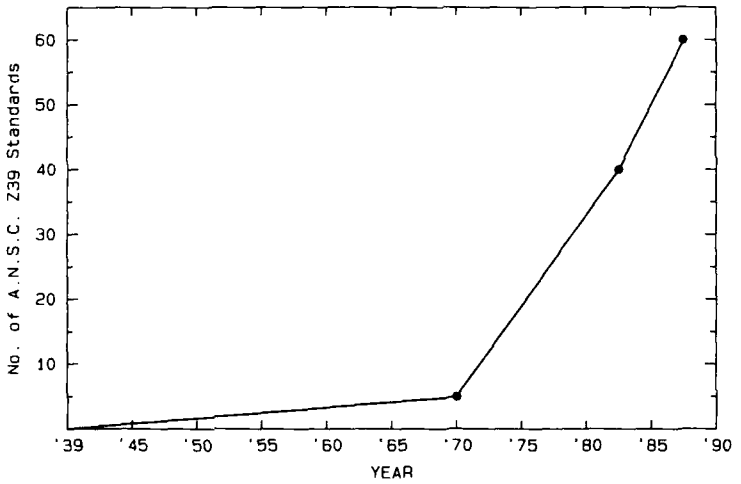


Figure 2. American Standards Relating to Information

UNIVERSAL BIBLIOGRAPHIC DESCRIPTION

Although the full effect of meeting the increased demand for information with static or often diminishing resources has only been seriously felt in the last two decades, libraries have long realized the benefit of a standard universal bibliographic description. Bibliographic description is the standardized description of an item in a collection providing accurate information about the physical and intellectual properties of the item. Not only does the bibliographic description or cataloguing distinguish the item from all others, it also notes where the item may be found in the collection. This objective of Universal Bibliographic Control (UBC) was set out by the International Federation of Library Associations (IFLA) in the early 1970's. The basic tenet of UBC is that any item published in any nation should be catalogued once according to an internationally accepted standard by the appropriate national agency such as a national library. All other nations and their libraries would copy this one original description.

Why has so much attention been paid to this exercise of consistently describing and indexing items in library collections? A major factor is that this enterprise has always been one of the most costly in libraries. In 1980 the cost of originally cataloguing a book was over $17 (McQueen, 1985). Averaging the inflation rate over the past eight years an approximate cost to libraries in 1988 would be close to $30. These high costs have caused librarians to attempt to limit the amount of original cataloguing that must be performed in-house, turning to standardized cataloguing which can easily be shared (McQueen, 1985).

In addition to immediate financial savings, high quality, internationally consistent cataloguing yields other benefits. A library's file of bibliographic records will last years while cards, catalogues, software, hardware and yes, even librarians come and go. The file is an investment that must be lasting and flexible for future technological developments. Even if new formats are required in the future, with standardized records we can easily take advantage of common conversion programs. It seems evident that cataloguing standards are essential in libraries for both short term savings and long term investment.

Cataloguing Rules

To understand our current status in the area of cataloguing standards, a brief historical summary is necessary. The development of cataloguing rules began over 140 years ago when Panizzi of the British Museum wrote the first major statement of cataloguing principles - Rules for the Compiling of the Catalogue. Then, in the 1900's the Library of Congress of the U.S. began selling copies of its catalogue cards for use in other libraries. This sharing of records caused a demand for cataloguing rules that would enable libraries to devise compatible cards locally. In the next forty years the Library of Congress, the British Library, the American Library Association and the British Library Association all published different editions of cataloguing rules. Finally, in 1961 fifty-three countries participated in the International Conference on Cataloguing Principles in Paris. The international bibliographic standard produced at this meeting has come to be known as the Paris Principles. Based on these principles we have witnessed the publishing of two editions of the Anglo American Cataloguing Rules by the national libraries and library associations of Canada, United States and United Kingdom (Wynar, 1980). The second edition of this work, known as AACR II, has been published in many different languages and has been widely accepted as an international standard (Delsey, 1987).

Integrated into AACR II is a true international standard known as ISBD - International Standard Bibliographic Description. This format, devised in the early 1970's under the auspices of IFLA, specifies the essential elements of bibliographic description; the order of the elements; the form of the elements; and certain standard punctuations. Figure 3 shows a catalogue card created with AACR II rules (Library of Congress, 1972).

AACR II's rules tells us for example to use "Unesco" as an entry, not "United Nations Educational, Scientific, and Cultural Organization"; or "University of British Columbia", not "British Columbia. University". Such examples may seem to be common sense, but in any room of people there will be as many different common sense approaches as there are people. If all cataloguers made decisions without the assistance of detailed rules such as AACR II, library users would never find the information they seek. Would the publications of this panel, for example, be found under Advisory Group for Aerospace Research & Development, or AGARD, or TIP, or Technical Information Panel? Or would they be listed only under title?

These rules have been interpreted and revised to accommodate language and cultural differences. They are also continually subject to differences of "practice" in local catalogues. Despite the many variations, a good deal of progress has been made in the past 20 years in the sharing and exchange of bibliographic records. As we have discussed, much of the standardization of bibliographic records has occurred to facilitate sharing of cataloguing in order to save money. This process has also been greatly influenced by advances in technology (Delsey, 1987). Computerization of library catalogues and the creation of standardized machine readable records has brought us one step closer to the international goal of universal bibliographic control.

Bibliographic Exchange Formats

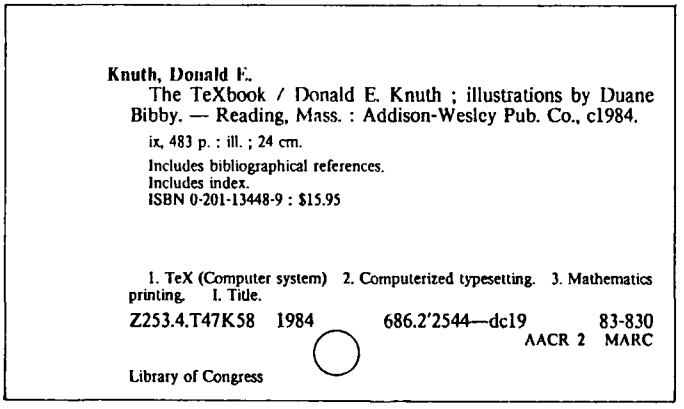
In order to exchange bibliographic records by computers, a second level of standardization above cataloguing rules is required. Standardized formats and guidelines for coding data to machine readable form are needed to translate the information catalogued. One of the most widely used coding systems, MARC, (Machine Readable Cataloguing) was initiated by the Library of Congress (LC) in the 1960's. The system was designed to enable LC to exchange records with other libraries on magnetic computer tape rather than on cards. It was not developed in isolation, but in consultation with the British National Bibliography so that exchange of records on computer tapes could take place. Since that time we have observed the development of many different national MARC formats: Canadian MARC, UK MARC, French INTERMARC, and German MARC to name a few. For an example of an LC MARC record, see Figure 4.

To better understand exchange formats, let us look at the elements of which they are composed. It is widely accepted that any bibliographic exchange format consists of three parts: the structure of the record; the content identifiers or tags; and the

contents or data themselves (Hopkinson, 1986). The structure refers to the arrangement of the data on the particular computer medium, most often magnetic tape. The universally accepted structure for exchange on magnetic tape is set out in an International Organization for Standardization Standard, ISO 2709, Documentation: Format for Bibliographic Information Interchange on Magnetic Tape which has been implemented as several national standards, such as ANSI Z39.2, American National Standard Format for Bibliographic Information Interchange on Magnetic Tape. ISO 2709 states for example that each separate piece of information must be first identified by a tag consisting of three characters. On a tape of MARC records, such fields as the title will always be preceded by its tag of 245 while the author field will be tagged with 100. This tagging means that any computer system can search for the particular tag to provide access to that field.

Although ISO 2709 specifies that there will be tags, it does not stipulate exactly what the tags will be. Therefore, at the second element of an exchange format we begin to see variation and several different systems of tagging or of designating data. MARC, a library associated tagging system, was designed to accommodate the complicated cataloguing rules described above. The Reference Manual for Machine Readable Bibliographic Descriptions published by UNESCO was created to facilitate the exchange of records in the abstracting and indexing community. The third major set of content designators is detailed in the Unesco Common Communication Format (CCF). This format was the result of a Unesco symposium in 1978 held in Taormina, Sicily, wherein a compromise was reached between the library and the abstracting & indexing communities. The Common Communication Format was intended to bridge the gap between the Reference Manual and MARC. However, its success is still to be realized. To the detriment of the international exchange process, there now appear to be three standard exchange formats where once there were only two. Computer programs have been written to allow exchange of records across these formats, but implementation of these conversion programs is expensive and complicated. In actual practice very little exchange occurs except between information organizations using the same format (Hopkinson, 1983).

The final element of any exchange format is the actual content of the record. This element is dependent on the cataloguing rules in use; on their application for the particular purpose at hand; and on the method that the exchange format uses to divide up the information. An example of these rules in the library community, AACR II has been discussed at length above. The abstracting and indexing community also uses sets of cataloguing-type rules to determine the contents of their records. These rules, however, seem to be even more varied than those used by the library community. Because abstracting services deal in specific subject areas, and because there is little public demand for exchange of records between these services, compatibility of content descriptions rarely exists (Wood, 1982).



Knuth, Donald E.
The TeXbook / Donald E. Knuth ; illustrations by Duane Bibby. — Reading, Mass. : Addison-Wesley Pub. Co., c1984.
ix, 483 p. : ill. ; 24 cm.
Includes bibliographical references.
Includes index.
ISBN 0-201-13448-9 : $15.95

1. TeX (Computer system) 2. Computerized typesetting. 3. Mathematics printing. I. Title.
Z253.4.T47K58 1984 686.2'2544—dc19 83-830
AACR 2 MARC
Library of Congress

Figure 3. Library Catalogue Card in AACRII Form

```
   RSN    PTC  OPN    DFC     DCR     DCH    TCH  LNG
 18624712 updt LC : 84Feb22 83Feb16 86Mar09 19:42
                    01:830216 02:     s 03:  1984 05:   mau 06:  a
                    09:  b    13:     1 14:     1 17:   eng 19:     d
                    30:     m 31:     a 32:     0 33:     a
 010    ........ 2001 $a   83000830 //r86
 020    ........ 2001 $a0201134489 (soft) :$c[$]15.95
 039    0....... 2001 $a2$b3$c3$d3$e3
 040    ........ 2001 $aDLC$cDLC
 050    00...... 2001 $aZ253.4.T47$bK58 1984
 082    0....... 2001 $a686.2/2544$219
 100    10...... 2001 $aKnuth, Donald Ervin,$d1938-
 245    14...... 2001 $aThe TeXbook /$cDonald E. Knuth ; illustrations by
                    Duane Bibby. --
 260    0....... 2001 $aReading, Mass. :$bAddison-Wesley Pub. Co.,$cc1984.
 300    ........ 2001 $aix, 483 p. :$bill. ;$c24 cm.
 500    ........ 2001 $aIncludes index.
 504    ........ 2001 $aIncludes bibliographical references.
 650    .0...... 2001 $aTeX (Computer system)
 650    .0...... 2002 $aComputerized typesetting.
Continue? (Y=yes or N=no)
y
 650    .0...... 2003 $aMathematics printing.
```

Figure 4. Library of Congress MARC Record

BIBLIOGRAPHIC STANDARDIZATION IN DEFENCE AND AEROSPACE

We have emphasized the importance of technical standards both generally and in the information industry, and indicated that international standards for descriptive cataloguing are of particular importance. With these standards in place libraries can save money by sharing resources and by creating files that will serve as long term investments despite changes in technology. The present degree of computerization has created a need for a second level of standards in the form of exchange formats. To what degree has this standardization process affected our information services in Defence and Aerospace?

It seems that defence information services have somehow managed to remain out of the turmoil of other library communities. Perhaps, however, we have not reaped some of the benefits resulting from the turmoil. In defence we are often trying to prevent people from finding our information, while other information services are striving to provide universal access. For this reason the need for a large shared catalogue has not been great. Further, defence library users normally need technical and applied information. The publications that are collected to meet this need for the most part are not esoteric and difficult to catalogue. Our information facilities contain straight forward, relatively easy to catalogue texts, manuals, journals, and technical reports. Therefore, the impetus to participate in standardized bibliographic processing with a view to sharing cataloguing has not been present. The question we must ask is whether it is now effective and appropriate for us to become involved in these international networks so rigidly controlled by complex standards. Would it be to our advantage to participate in sharing of bibliographic records, and if so how might we proceed to bring our procedures in line with the international standards that exist?

Books and Periodicals

It appears to be both appropriate and advantageous to participate in a system of universal bibliographic control for defence oriented collections of books and periodicals. As many authors point out we will save time and money by copying cataloguing from large shared cataloguing systems (Delsey, 1987; Hopkinson, 1984; McQueen, 1985; & Paul, 1982). We will also create a database of standardized bibliographic records which can then be easily manipulated by most library automation software packages. When there are new technological developments, our standardized records will be ready to be included in any conversion programs required. There is no longer a need to develop costly and short-lived in-house systems to provide access to our book and periodical collections. If we are willing to contribute effort at the "front end" the result will be a profitable long term investment. The money and time saved as a result of shared cataloguing can be invested in providing a higher quality of service to our clients.

Technical Reports

The standardization of bibliographic records for technical reports, however, is not as easy to implement as standardization for books and periodicals. Reports are referred to by many as "grey literature" in reference to the difficulties encountered in

identifying and obtaining them. They are produced quickly to present vital technical information in a published format, but this process means that they often are not subject to the rigors of other types of publications. They are often soft bound with little accurate identifying information. For example, the title may be different on the cover, the title page and the document control sheet! Reports frequently don't present a complete picture of ongoing research, as they cover only one phase of development (Burress, 1985). They are not indexed in valid abstracting and indexing systems and many libraries do not even provide subject access to them. For these reasons technical reports have not been of primary importance to most libraries and information centres, and hence, they have not been thoroughly considered in the information handling standardization processes.

Technical Reports - Cataloguing Rules

In North America those of us whose clients depend on technical reports create bibliographic descriptions of our reports according to the American Committee on Scientific and Technical Information (COSATI) Standard entitled Guidelines for Descriptive Cataloging of Reports. Defense Technical Information Center (DTIC) in the U.S. and Defence Scientific Information Service (DSIS) in Canada have both published their own applications of the COSATI rules for use in defence information centres at the national level. However, it appears that there has been no formal discussion of possible compromises which could lead to complete compatibility between the two sets of rules. Both the COSATI guidelines (1978 version) and the DTIC rules (1984 version) were consulted by DSIS when the last revision of the DSIS rules was produced in 1985. Unfortunately, because of existing and historical procedures at DSIS, this Canadian version could not be 100% compatible with the American version. Similarly, within the Department of National Defence in Canada the report cataloguing institutions seem to use the DSIS standard only when it conforms to existing local practices. This standardization problem has been addressed nationally in the United States by the Commerce, Energy, NASA, Defense Information (CENDI) Cataloging Committee who published in 1985 Guidelines for Descriptive Cataloging of Reports. This new revision of the 1978 COSATI guidelines presents rules that "govern the form of the essential cataloging elements for reports processed by the major federal information processing agencies: U.S. Department of Commerce, U.S. Department of Energy, National Aeronautics and Space Administration, and U.S. Department of Defense" (Guidelines, 1985). Its publication is a welcome addition to American report cataloguing standardization and the experience gained by the CENDI Cataloging Committee in producing this standard could serve as a starting point for future international cooperation.

Technical Reports - Exchange Formats

Not only is there a problem with lack of standardization of cataloguing rules for technical reports, but we encounter another problem at the exchange format level. Standardized international tagging systems such as MARC do not exist for the exchange of technical report records. In the U.S. the defence agencies belong to a shared cataloguing network, but this network is mainly limited to the defence community and in 1985 it was stated that the system's design did not readily permit downloading of records to create local catalogues (Burress, 1985). However, one of the six main objectives of the revised COSATI guidelines of 1985 was to standardize tags for the exchange of machine readable data. This indicates that machine readable report cataloguing is indeed being shared to some extent in the U.S. In Canada there is no vehicle for sharing cataloguing of technical reports nationally, but computerized exchange of records is being considered. For the time being each information centre produces all its cataloguing originally. DSIS has access to the American cataloguing network, but in a "read only" capacity for database searching. DSIS also receives copies of the American and British magnetic tapes of report records, but these are standardized only with respect to the structure (using ISO 2709) while the tagging systems and cataloguing rules are incompatible (both with the Canadian systems and with each other!).

Technical Reports - Recommendations

Based on comments above concerning the advantage of standardized bibliographic processing, it appears that technical report users, and the information community as a whole could benefit greatly from internationally standardized cataloguing rules and exchange formats for technical reports. The steps towards this standardization would be lengthy, difficult and costly to initiate. Further, as Henderson suggests, long term commitments and binding obligations would have to be undertaken by the national agencies precluding many unilateral decisions (1980).

However, the advantages far out weigh the disadvantages. Defence information centres would enjoy considerable cost saving through large international standardized catalogue sharing systems, and our catalogues created in this fashion would be standardized to survive as a long term investment. In cooperating we could share experience and expertise within the report community and the information community as a whole. To quote an appropriate cliché, we would not find ourselves "reinventing the wheel". It has also been suggested that as a large unified international network we would carry more influence in political decisions affecting the information industry (Henderson, 1980). Finally, and most importantly, as processing costs are cut and access to records is improved, we will be able to provide superior quality information service to our technical report users.

CONCLUSION

In conclusion, we have discussed the rise in importance of standards in the information handling business. With our economy turning from a product basis to an information basis, librarians and information managers are being pressured to provide increased and better service with static or often diminishing resources. Standardization has helped us keep costs down and allowed us to optimize our use of technological advances. Standards for the creation of bibliographic records are no longer esoteric doctrines for high quality control, they are fast becoming practical and necessary tools for improved service. The Defence and Aerospace information communities have historically been out of the main stream of bibliographic standardization. However, like all other information centres, our services can benefit greatly from cooperative standardization, and we should whenever possible take advantage of the systems in existence for books and periodicals. Further, we have an important contribution to make to the information industry in the area of technical report processing standardization. Report bibliographic description and record exchange have not yet been seriously considered for international cooperative standardization. Since the processing of technical reports is our area of expertise and interest, we should promote national and international actions to standardize in this area. Standardized bibliographic processing of reports would benefit us and the rest of the information community financially, technically and politically. Most importantly, standardization in this area would benefit our clients.

REFERENCES

Anglo-American Cataloguing Rules: 2nd Edition. Chicago: American Library Association, 1978.

Burress, Elaine P. "Technical reports: a comparison study of cataloging with AACR2 and COSATI." Special Libraries 76 (Summer 1985): 189-192.

Cohen, Dian. "Libraries in the Information Marketplace." Paper presented at the Canadian Library Association Conference, Halifax, Nova Scotia, June 1988.

Defence Technical Information Center Cataloging Guidelines. Alexandria, Virginia: Defence Technical Information Center, 1987. (NTIS order no. AD-a177-700/2/XAD)

Delsey, Tom. "Standards for descriptive cataloguing: two perspectives on the past twenty years." Paper presented at the Conceptual Foundations of Descriptive Cataloguing, Los Angeles, Calif., 1987.

DSIS Standard for the Descriptive Cataloguing of Scientific and Technical Reports. Revised edition. Ottawa: Department of National Defence Canada, Director of Scientific Information Services, 1985.

Guidelines for Descriptive Cataloging of Reports: A Revision of COSATI Standard for Descriptive Cataloging of Government Scientific and Technical Reports. Washington, D.C.: Commerce, Energy, NASA, Defense Information (CENDI) Cataloging Committee, 1985. (NTIS order no. PB86-112349/XAD)

Henderson, Madeline M. Study of Cooperation in the Processing of the Technical Report Literature. Performed by Committee on Information Hang-ups. Springfield, VA: National Technical Information Service, 1980. (NTIS order no. PB81-196495)

Hopkinson, Alan. "New technology and exchange formats." Journal of Information Science 7 (December 1983): 139-147.

Hopkinson, Alan. "International access to bibliographic data: MARC and MARC-related activities." Journal of Documentation 40 (March 1984): 13-24.

Hopkinson, Alan. "Developing the Common Communication Format." Information Development 2 (April 1986): 99-104.

Library of Congress. "International Standard Bibliographic Description." Library of Congress Cataloging Service Bulletin 104 (May 1972): 8-9.

McQueen, Judy and Boss, Richard W. "Sources of machine-readable cataloguing and retrospective conversion." Library Technology Reports 21 (November/December 1985): 597-613.

Paul, Sandra K. and Givens, J.E. "Standards viewed from the applications perspective." Library Trends 31 (Fall 1982): 325-341.

Paul, Sandra K. "Library standards: an introduction to organization and the standards process." Library Hi Tech 2 (March 1984): 87-90.

Rush, James E. "A proposed model for the development of an integrated set of standards for bibliographic and related data." Library Trends 31 (Fall 1982): 237-249.

Standards Council of Canada. Catalogue - National Standards of Canada. 2nd edition. Ottawa: Standards Council of Canada, 1987.

Wood, James L. "Factors influencing the use of technical standards in a nationwide library and information service network." Library Trends 31 (Fall 1982): 343-358.

Wynar, Bohdan S. Introduction to Cataloging and Classification. 6th edition. Littleton, Colo: Libraries Unlimited, 1980.

Indexing and Abstracting

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Summary

The aim of content analysis of documents is to describe the intension of documents in condensed form as a documentation unit, to order and store it and to retrieve the document by user request. To do this, formal systems of ordering (classifications), indexing terms of natural language-based or artificial documentation languages as well as abstracts formulated in a natural language are employed.
Whereas classing establishes paradigmatic relations, indexing (keywords, subject headings, descriptors) provides the possibility to identify the content in a natural language and to establish syntagmatic relations; the process of indexing, indexing principles, methods and results will be described; the existence and basic principles of thesauri will also be discussed in this connection.
In contrast, an abstract is a statement of contents formulated in a natural language with the purpose of setting forth not only the relevance but also the contents of a document concerning a specific subject; the different types of abstracts and the abstracting procedures will be dealt with. It is emphasized that retrieval is the reversal of the intellectual processes classing, indexing and abstracting, which is indicative of the special importance of these processes for the efficacy of technical information systems.

1. Introduction

Ordering and marking are the prerequisites for being able to undertake a well-directed search in a not specifically defined set of stored documentation units according to user request criteria and to retrieve the relevant documents - and only those. On the other hand the information on the subject content of the retrieved, subject-relevant document is an important selection criterion; but it can also be used for retrieval purposes.
However, to order and mark documents requires a basic cognitive process in the course of which the document is perused, the content understood, analysed and structured so that the document can be included in a system of ordering - as the formal component - and/or the contents are marked by means of a documentation language. This process is called content analysis. It is the prerequisite for ordering (class), marking the contents (descriptors) and describing the subject content (abstract); thus, it is also a requirement of retrieval. Recall and precision - as a measure of retrieval quality - may therefore be seen as a function of content analysis; it depends on the intellectual capacity of the documentalist and the quality and efficacy of the system of ordering or the documentation language applied and its instruments.

2. Content Analysis

2.1 Purpose and Tasks of Content Analysis

Content analysis is the intellectual process by which and in which the content of a document

> ('document is that object of a documentation process the content of which is coherently described. It may be, for example, a book or a chapter of a book, a film or a filmclip, a patent specification, an essay in a journal or an abstract'. (2))

is adapted or transformed according to the requirements of the respective technical information system; i.e. the document is turned into a documentation unit. It represents the document in the storage of the technical information system. It is therefore the purpose of content analysis to present the essential document contents in a concise, condensed form and to make this compression of contents retrievable by incorporating it to a formal system of ordering and indexing. This is achieved by using a documentation language which is defined as follows in (2):

> 'A documentation language is a set of language expressions serving to describe documents in accordance with specific rules for the purose of retrieval. Documentation languages are, for example, systems of subject headings, thesauri and classifications. They include terms from natural and/or artificial languages'.

At this point it must be emphasized that the search process in the DP storage is directed exclusively at he documentation unit. But content analysis also has the purpose to inform the reader as to wether the subject content of the generally relevant document is really what he needs. For this purpose the subject content of the document is described in an abstract. The quality of content analysis is therefore decisive for the success of a search conducted on the basis of content criteria and for the reliability with which the user selects the documents useful to him from the relevant documentation units offered.
This twofold task requires that both tasks - the retrieval function and the content-oriented function - are always taken into consideration in content analysis.

2.1 Procedure

Content analysis starts with the cognitive process of document analysis in which the technical documentalist clarifies problems such as:
- Which facts are dealt with in the document?
- Which procedures, processes, projects are described?
- Which statements are made?
- Which conclusions are drawn by the author?
- Which results are communicated?
- Where does the main emphasis of the work lie?
- Which new information is contained in the document?
- Under which conditions is the document supporting?
- Which premises underlie the statements made?

It is especially important to differentiate and discriminate clearly between subject-related statements (relevant main content), redundant statements, excurses and secondary aspects.
In practice, the technical documentalist starts by reading the document to find out what information is actually contained in the document. The reading intensity essentially depends on the text's degree of difficulty (technical and intellectual level), its structure, language, type of presentation by the author and the length of the document as well as the technical documentalist's technical and intellectual qualification. In addition, the information specialist must be able to think analytically, work systematically, judge critically and impartially and also use his powers of abstraction and imagination; finally he must be able to present the results of his work in a concise, comprehensible form.
On the basis of the knowledge thus acquired about the document, the document contents can now be discriminated and selected, and the information contained therein evaluated in relation to the subsequent
- incorporation into a system or ordering (classing)
- marking of subjects (partial subjects) (indexing)
- description of subject content (abstracting).

There is then a smooth transition from this phase into the process of indexing which finally results in the documentation unit.

Annotation:

Under the premise that the following definitions should apply:
- 'Indexing (result) encompasses all methods and procedures, as well as their applications, which result in the assignment of descriptors or notations to documents for the purpose of content analysis and specific retrieval'. (2)
- 'Indexing (process) is the assignment of descriptors or notations to a document in order to describe the individual facts contained therein. It is governed by indexing methods and procedures'. (2)
- 'Descriptors are names (see DIN 2330) which if used alone (e.g. unambiguity) are suitable for marking contents and can be used in the respective documentation system'. (2)
- 'Notations are designations taken from artificial or formal languages, which represent a concept or a class of concepts and are used for marking contents'.(2)

In the following the common generic term of descriptor and notation is substituted by the designation index term. This means that in the further course of the discussion the term indexing also includes classing as well as labelling with keywords, subject headings or descriptors. Notwithstanding this, classing will have to be dealt with.
No generally valid time specifications can be given for the process of 'content analysis'; it can only be stated that considerable time is required for this process. Short, simply well-structured documents formulated in graphic language will require less time than long, complex documents of a high level of abstraction which cover fringe areas of the technical documentalist and are written in a foreign language. Empirical values range from minutes to hours; for natural science subjects a scheduled time of one to two hours per document is accepted as the norm.
The quality of content analysis is a function of time spent and it always takes precedence over the quantity. However, quality and time spent are not proportionate to one another. The quality/time spent relation is initially governed by the time factor which, however, increasingly loses importance after a certain point; the time required for a quality increase becomes unproportionately long. Once this 'break-even point' has been reached, additional time cannot be justified.

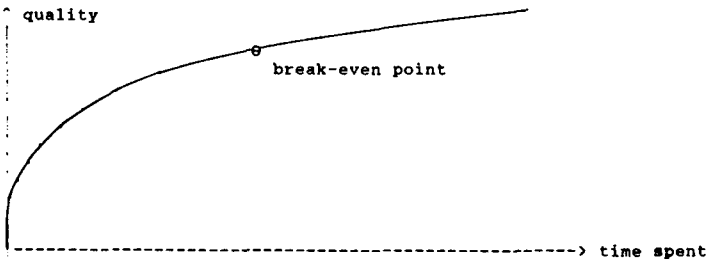

Fig.: The Relationship Between Quality of Content Aanalysis and Time Spent (1).

2.3 Implications of Hardware and Software

All data derived from content analysis, supplemented by the required bibliographic and formal data, are stored and managed in the data bank. To ensure the reliable ordering and storing of data and their reversal, successful retrieval, it is necessary during content analysis itself to pay need to the special conditions, peculiarities and limitations inherent in the use of hardware and software.
There is also a further complicating factor. While the technical documentalist interprets the meaning of the contents intellectually and transforms it into character strings, during retrieval the stored character strings are only compared with those entered (search words) without any interpretation of their meaning. Polysemy, homonymy and synonymy, homography and different spelling, the use of abbreviations and other linguistic variants, especially the differing individual ability of linguistic expression (linguistic usage and vocabulary) are all factors affecting retrieval.
As a function of hardware and software
- complex terms, word fragments, abbreviations and acronyms
- type designators, etc.
- digits, figures and dates
- formulae, symbols, special characters and indices
- measurements and physical/technical designations

constitute problem areas which, to varying degrees, are in need of clear regulation.

3. Ordering and Systems of Ordering

The elements in the set of elements to be arranged are ordered according to characteristics of arrangement. These are formal or conceptual attributes of the objects, including the characteristics artificially assigned to them (e.g. physical, extrinsic, functional characterstics). The given characteristic types define the arrangement classes which can be classified according to e.g. formal and concept classes. Since ordering can be regarded as the arrangement of relations, the relations existing between the arrangement classes must be laid down. For this purpose, either the linear or the hierarchical principle, for example, may be applied. If these principles are applied, four possible basic types of arrangement result (formal, systematic-hierarchical, perspective, correlative) which are also designated principles of arrangement. They provide the basis for the total system of interrelated arrangement classes, each class being determined by the superior complex whole. This however, has resulted in an arrangement system which constitutes the arrangement of elements to form a complex whole according to rational or pragmatic aspects; it is structured in such a way that it provides an overview of the field of knowledge which is as complete as possible. If the elements of the system encompass all fields of knowledge, the system is then a universal one (e.g. decimal classification); if they cover only one specific field of knowledge, it is a special system (e.g. technical classification).
In information and documentation the expressions 'system of ordering', 'classification', 'classification system', 'systemalogy', etc. are usually employed as a common description for classification, arrangement and retrieval systems which - strictly speaking - ought to be distinguished between. Classification does not necessarily include any kind of arrangement; it is simply the translation of complexes of concepts or thematic units into terms. To ensure the required clearest possible assignment of terms and concepts, a system of rules is needed and this is called a classification system.
The system of ordering, on the other hand, is a set of rules on the basis of which the classified subject content (in the form of terms) taken from documents are translated into a set of ordered elements.
The process of incorporating the documents into this system of ordering is known as classing.

3.1 Classing

While classing is of secondary importance for a subject-oriented technical information system and therefore rarely applied, it is an essential arrangement and retrieval instrument for interdisciplinary and universal technical information systems. It enables the technical documentalist to allocate the document to the respective field of knowledge and in this field to the pertinent subject area. This allocation is shown in a notation by which correlation with the intensions is made possible.
This process can be illustrated using a metaphor which has already been employed before: the arrangement systematology is like a large cupboard, the fields of knowledge being represented by large drawers which are subdivided into compartments according to the subject areas. The technical documentalist puts the documents in to this drawers - and into the respective compartments.
Example:
The content analysis of a document reveals that the subjects 'aircraft' and 'navigation computer' are dealt with. In accordance with the Cosati classifcation (7) this document covers two subject areas:
- aircraft instrumentation
- navigation and control

This means that the technical documentalist places the document in the appropriate drawers/compartments by attaching the respective notations '01.04' and '17.07' to it.
Classing roughly sorts the documents. It can therefore also be useful for retrieval purposes. The document of the above example is not only included in the set of all documents on aircraft but also in that on navigation; the cut set comprises all documents dealing with aircraft navigation. Classing, however, must be liable and not confused with indexing.

The number of notations employed depends on the complexity of the document, i.e. the number of fields of knowledge/subject areas which the document/contents must be allocated to. The following basic principle holds: The more specific the document, the less notations are required.

4. Indexing

4.1 Concepts

Before looking at this subject in detail, it would seem useful to define some concepts to ensure uniform linguistic usage. 'Indexing is understood to be the entire range of principles and methods, procedures and their application which are necessary to assign descriptors to documents for the purpose of content analysis and specific retrieval' (see Chapter 1).
'An indexing method is a concept of indexing which allows content marking, storage and retrieval of documents' (2). 'An indexing procedure is characterized by the indexing method(s) specified in a system of rules in a specific documentation system' (2). 'A thesaurus is a natural language-based documentation language aiming at one-to-one correspondence of natural-language concepts and terms; this is achieved by complete vocabulary and terminological control and the representation of the concepts and the relations existing between them by depicting the relations between the terms and additional resources, if necessary'. (9)

4.2 Purpose and Tasks of Indexing

Recall and precision are a function of indexing; i.e. the number of relevant documents which can be found with as little noise as possible in answer to a specific request depends on indexing. Also in large data bases there is, of course, the possibility of free-text searching; it increases recall but also shows documents in which the search word appears in the context only and has a different function or purpose than marking the contents.
The search process using descriptors increases precision. Upon content analysis of the problem and its description by pertinent descriptors, the indexing process is reversed by inferring the content from the content marking. This is why one-to-one relations are required. This reversibility is a measure of the quality of indexing. It is the higher the more precisely the concepts contained in the document are or can be described by names from the thesaurus; i.e.:
- to find the most accurate descriptor and
- to describe the specificity of the document's subject content by an equally specific descriptor.

4.3 Indexing Methods

The indexing methods discussed in the following may constitute components of one and the same indexing procedure, i.e. in a particular procedure severel different methods may be employed (e.g. intellectual coordinate indexing with descriptors but without any preferred terms).
As far a the type of implementation is concerned, a distinction can be made between 'intellectual indexing' (the index terms are assigned on the basis of intellectual content analysis of the document without computer assistance), 'computer assisted indexing' (with the aid of a processing unit index terms are proposed; this can be done by comparing the already existing indexing results or by automatic preselection from the document text) and 'automatic indexing' (the index terms for a document are determined by the data processing unit).
If index terms of equal rank are allocated to the respective document, irrespective of their hierarchical level and their document-specific relationships, this is called 'coordinate indexing'. However, since content analysis covers three levels, that is to say the syntactic, semantic and pragmatic, it becomes evident that the total number of all index terms used in coordinate indexing cannot adequatly describe a document because its semantics is ignored. 'Syntactic indexing' is an approach which encompasses the semantics of a document. In this type of indexing the index terms also provide for special identification of their weight, role and/or varying degrees of linkage in the respective document. Thus, for example, roles or links may express the syntactic relations. In this connection, the references 4, 5 and 6 are in focus.
In the documentation language, a distinction can also be made between indexing using descriptors and notations. While in the first case the document content is identified by using terms constituting the vocabulary of a natural language-based documentation language - e.g. of a thesaurus -, in the second case the vocabulary belongs to an artificial or formal documentation language (e.g. of a classification).
If a natural language-based documentation language is used, descriptors can be taken from the document; this is called the extraction method. Its advantage lies in the fact that all concepts expressed sufficiently explicitly in the document text are acquired quickly and specifically; implicit concepts, however, may be lost in the process. This disadvantage can be avoided by adopting the addition method in which descriptors are assigned which need not necessarily be directly contained in the document; it must be admitted, however, that this impairs the consistency of indexing.
Taking the special problems inherent in the addition method into account, the advantages of both indexing methods can be combined and the disadvantages to some extent excluded.
Notations are established in a similar way; however, the subjects, ascertained in a given document are not identified by terms of a natural language-based documentation

language but are translated into notations of the notation language employed.
Finally, the binding nature of the documentation language, i.e.indexing with a free or binding vocabulary, should be mentioned as a distinctive feature. If a free vocabulary is used for indexing, the descriptors need not to be taken from a vocabulary whose use is binding. This does not preclude the existence and employment of keyword and subject heading lists as reference works. In this way, fast and specific identification of contents is possible since the translation of concepts (documents) into names (documentation language) does not apply; at the same time, possible losses of information and inconsistency of indexing are avoided and response to linguistic developments and new technical terms is possible without delay. On the other hand, the absence of terminological control requires an extraordinary intellectual effort in retrieval as far as synonymy, homonymy, the names of technical terms and the permanent shifting of their concepts is concerned; the lack of grammatical and orthographic control intensifies the problem. If, however, the use of binding descriptors is required (subject heading list, thesaurus, classification, i.e. indexing using a binding vocabulary), then indexing and retrieval are also independent of the linguistic formulation of the concepts contained in the document. This slows down and complicates the indexing process, though, since the concept is now translated into the documentation language by the technical documentalist. This may reduce the specifity and consistency of indexing and result in a loss of information.
The intellectual requirements are transferred to the technical documentalist who must not only have considerable knowledge in various subject fields but also complete mastery of the documentation language. New linguistic developments and new technical terms cannot be incorporated into the documentation language without delay.
If free and binding vocabularies are used in indexing, the advantages of both methods are utilized and the disadvantages avoided. In this connection, corresponding categories (data fields) are allocated to the descriptors (controlled vocabulary), keywords and subject headings (uncontrolled vocabulary).
Indexing as a result of an intellectual process - the translation of document intensions into documentation language names - is measured on the basis of four qualitative criteria. With respect to the document's technical content the range of index terms indicates the depth of content analysis; the number of allocated index terms provides a rough indication. The indexing specifity shows how specifically the document content is described by the index terms; their hierarchical level provides an initial indication. The combination of the range and specifity of index terms is the depth of indexing. It specifies the accuracy of document content description by indexing; a corresponding indication is provided by the number and the hierarchical level of the allocated index terms. Finally, the consistency of indexing is the measure of agreement of different types of indexing of the same document in the same documentation language; here, an initial indication is provided by the ratio of the jointly allocated to the total number of all allocated index terms.

4.4 Indexing Practice

The process of indexing essentially involves two working steps:
(1) Determination of the concepts and concept complexes contained in the document
(2) Translation of the thus determined concepts into index terms of the documentation language used.

While assigning the document to a field of knowledge/subject field for classing purposes, the technical documentalist looks at the topics and subtopics, that is to say the concept complexes and concepts dealt with in the document. He may proceed as follows: All subjects covered are listed using either keywords from the document's text or the documentalist's own formulations, and then arranged (structured) in blocks according to the document's structure. In this way it is ensured that no important information is lost. From this list of concepts those are now selected which represent the essential contents of the document (i.e. if the document is to constitute the answer to the inquiry about this very concept). In this case, the author's intention as well as the user's information needs should be included as possible selection criteria. When selecting the concepts or their names it should be noted wether they are explicitly or only implicitly dealt with in the text. The selected concepts must be searched for using the names of the documentation language employed and represented by index terms.
It must first of all be checked whether the terms taken from the document text are admissible. The alphabetic portion of keyword lists, subject heading lists and thesauri provides information about the entire inventory of admissible vocabulary. If the term searched for is not found, synonyms must be looked for; the search in the systematic portion (class or generic term) often leads to additional pertinent index terms. Since, however, the number of admissible terms is limited, it may happen that a pertinent term for a complex concept does not exist. In this case, the concept complex must be carefully analysed and then factored to describe its intension i.e. all concept components using a combination of already existing index terms which are as specific as possible.
Based on the definition of the concept to be factored, the concept characteristics are laid down, the inidvidual concept components determined and described by terms which may well have common concept characteristics. Whenever a concept is factored, the hierarchical level of the component should be as close as possible to the complex with no shifting or even distortion of the meaning. Therefore, the concept must undergo semantic factoring into components of meaning but not morphological factoring into word components; the latter inevitably leads to wrong results.
The combination of concepts, i.e. the combination of several general concepts to form a more specific one, often proves necessary.
Before making a final decision on all the index terms, it should be checked whether incorrect combinations and thus false drops and noise may have to be expected in

retrieval if index terms are combined by the logical opertor 'and'. In conclusion, it should be noted that a document should always be indexed as a whole and not in the form of a summary or disposition, an extract or abstract. Shortened representations of the contents also inevitably shorten the substance of the subject content whereby the desired indexing specifity is not attained.

5. Abstracting

5.1 Definition

While indexing is used to identify the concepts and concept complexes contained in a document, the abstract describes in a natural language the subject contents in connection with these concepts and concept complexes. It presents the contents of the document in a condensed, but complete, accurate, objective, unambiguous, meaningful and comprehensible form, without being able to substitute the document itself.

5.2 Purpose and Task of Abstracts

According to this definition, primary function of the abstract is to indicate the subject contents. It should enable the technical information system user to form an opinion as to whether a document which has been found is relevant to his specific information requirements (relevance check) and to decide whether he needs the document for his work because of its special subject content (order decision). For this reason, the document as a whole must be represented by an abstract in which the subjects covered are described, the problems presented and discussed, methods and problem solution indicated, etc. It is possible for these requirements to be met in the abstract because the documentalist has at his disposal the manifold modes of expression inherent in a natural language - in contrast to the formal index terms of a documentation language; he can emphasize the main points, indicated intentions, tendencies and other qualitative aspects of the document; he can express nuances, take into consideration orthographic differences in relation to the documentation language, rarely used (foreign-language) technical terms and the coinage of new terms. In this respect, the whole complex of abstracts also constitutes a source for generating new descriptors. Abstracts, however, are particularly suited to express contexts of meanings and facts (e.g. years, periods of time, proper names), which is not possible by classing and (coordinate) indexing.
The documentalist, whose task it is to prepare an abstract true both to the document and its author, therefore bears special responsibility vis-à-vis the document and the author but also - as author of the abstract - vis-à-vis the user. To understand the process of abstracting in this way, is to substantiate the view that abstracting is an independent, intellectually demanding task.
Proceeding from the above requirements, a proper abstract should encompass the following characteristics:

Completeness: Making the best possible use of the number of characters available for the abstract, all important facts contained in the document should be described, and points of main emphasis and secondary aspects set forth. If too many facts seem to be essential, formulation should be based on that abstraction level on which all essential facts can be covered.

Accuracy: The abstract should describe the specific information content of the document and the author's opinion free of errors and distorsions. As far as sociological and humanistic documents, in particular, are concerned, shifting of emphasis can be avoided by sensitive formulations, marking of literal quotations and the author's explicit opinion. Accuracy also implies, however, that the abstract must be a 'true-to-scale' representation of the document and also correspond with the document with respect to contents and form. This means, in concrete terms, that the linguistic-stylistic form and the abstraction level of the abstract should reflect the intellectual level and demands of the document.

Objectivity: Formulations containing a value judgement contradict the objectivity requirement. Therefore, the technical documentalist should refrain from any value judgement and when preparing the abstract ensure that any formulations taken from the document cannot be interpreted as a value judgement. Stylistic means such as quotations or indirect speech can be very useful here.

Comprehensibility and unambiguity:
A clear style with a simple syntax is essential if the abstract is to be meaningful and readable. It should therefore consist of many short sentences, each containing only one factual statement. Compared with long sentence constructions, in which several different facts are articulated, short sentences have decisive advantages, particulary for retrieval purposes. On the other hand, so-called telegraphese (omission of articles and verbs), the use of reflexive pronouns and negative statements affect readability and make it difficult to understand the text; the latter inevitably lead to false drops in retrieval.

Some of the above requirements are hardly compatible, if not even contradictory. In view of the number of available characters (usually about 600 to 1.200 characters) completeness can hardly be achieved; on the other hand, completeness and shortness (i.e. high information density) are detrimental to comprehensibility. Accuracy and shortness also compete with one another since a relatively long text (many characters) is required for an accurate description of contents. The technical documentalist will, therefore, always have to consider carefully in each individual case whether and, if so, which of the requirements should take priority in order to do justice not only to the subject content

and the author's intention but also to the subject area and the user group.

5.3 Forms and Types of Abstracts

There are different ways of preparing and structuring abstracts which the technical documentalist can employ with a view to meeting the requirements detailed in the preceding section.
As far as the author is concerned, a distinction can be made between an author's and a non-author's abstract. An author's abstract is one which has been prepared by the author of the document himself. Since the author is not familiar with the specific documentation requirements and often pursues a different goal, author's abstracts should always be checked for their usability for documentation purposes. In this connection, it should be taken into special consideration that the author frequently uses the introduction for his own abstract, thus exceeding the number of available characters reducing the meaningfulness of the document and including document-extraneous facts. Suitable author's abstracts may well be taken over in their entirety or in a slightly changed version; in this case they are to be marked accordingly. The non-author's abstract, however, is prepared by the technical documentalist or similarly trained specialist.
As far as the format is concerend, a distinction is to be made between a telegraphic, textual and structural abstract. In the former case, subject headings are allocated for describing the contents, and chains of subject headings (series) are employed to depict the context of meaning. This can by nature be only very incomplete, but it provides an additional possibility for retrieval in the overlapping area between content marking and content description. The predominant abstract format is the textual abstract describing the contents of a document in a natural language (possibly telegraphese). The time required for preparing this format is much longer than that for a telegraphic abstract, but only the textual abstract is able to represent complex facts or concrete results with an adequate degree of comprehensibility. In this connection, the structural abstract constitutes a special format, since it can only be applied to homogeneous documents in which the attributes are limited in terms of number and subject content.
Finally, the scope of the contents is an important distinctive characteristic. For a very extensive document with numerous factual statements, an abstract will scarcely be able to describe the topics, methods and results obtained. In this case, the abstract, like a table of contents, will simply indicate the topics dealt with; this is then an indicative abstract. The informative abstract, however, reports on premises, goals, methods, results, conclusions and other information relating to the topics dealt with. It is evident in this case that only part of the information contained can be described - if only because of the usually necessary textual abstract format. The informative abstract is selective on a logically consistent basis. It is particulary well suited for scientific treatises with well-defined objectives and few but succinct results; it is also very well suited for the entire range of arts and social sciences. The indicative-informative abstract, as a mixed form, attempts to combine the advantages of both formats. For documentary purposes this type of abstract is usually used, with varying emphasis on the indicative or informative aspect.
Under the premise that the format must correspond with the contents, the technical documentalist has at his disposal a number of stylistic forms and means in the abstract formats described above which enable him to meet his responsibility not only vis-à-vis the author and the document but also the user.

6. Conclusion

Classing, indexing and abstracting are tools for the content analysis of documents, an activity which is of central importance in the entire documentation process. One-to-one content analysis is the prequisite for the guaranteed retrieval of documents containing relevant information.
Therefore, the indexing methods and procedures discussed must always be seen under the aspect not only of content analysis but also retrieval. In this respect, content analysis and retrieval constitute a complementary pair of concepts. If the main emphasis of intellectual work is shifted to classing, indexing and abstracting, retrieval is facilitated; the intellectual effort however, is shifted to retrieval, if content analysis is to be facilitated.
Proceeding from this fact, the presentation of the methods and procedures dealt with here aims to serve as a basis for a technical information system by emphasizing the interrelationship between content analysis and retrieval. Concrete indexing procedures have not been addressed here since content analysis methods depend largely on the subject area, the documentation language used as well as hardware and software. For this reason, concrete indexing procedures must be developed by each individual technical information system for its own system-specific conditions and laid down in its on set of rules.

References:

1. Fachliche Arbeitsanweisung für die Dokumentation: Bearbeitung von Dokumenten durch den Fachdokumentar (FachADOK Nr 3). Dokumentationszentrum der Bundeswehr: Bonn 1985
2. Indexierung zur inhaltlichen Erschließung von Dokumenten / Begriffe Grundlagen. DIN 31 623 Teil 1, Beuth, Berlin =D= 1983
3. Indexierung zur inhaltlichen Erschließung von Dokumenten / Gleichordnende Indexierung mit Deskriptoren. DIN 31623 Teil 2, Beuth, Berlin =D= 1983
4. Körner, Horst, G: Syntax und Gewichtung in Informationssprachen / Ein Fortschrittsbericht über präzisere Indexierung und Computer-Suche. Nachrichten für Dokumentation (1985) Nr 2, S.82-100
5. Müller, Jan: Probleme der Informationswiedergewinnung im Dokumentations- und Informationssystem Verteidigungsdokumentation (DOKIS-VgDOK) mittels des Retrievalsystems (STAIRS) unter besonderer Berücksichtigung des Thesaurus VgDOK. Dokumentationszentrum der Bundeswehr: Bonn 1984
6. Müller, Jan: Verbesserung der Retrievalergebnisse in DOKIS-VgDOK bzw. STAIRS durch Einführung einer syntaktischen Indexierung. Dokumentationszentrum der Bundeswehr: Bonn 1984
7. Thesaurus of Engineering and Scientific Terms: dt. Ausg.= Ein technisch- wissenschaftlicher Thesaurus / Aus dem Amerikanischen übertragen. - Frankfurt am Main: IDD-Verlag für internationale Dokumentation, 1982. ISBN 3-8151-0014-3
8. Thesaurus Verteidigungsdokumentation (Thesaurus VgDOK). 5. Auflg. Dokumentationszentrum der Bundeswehr: Bonn 1985
9. Terminologie der Information und Dokumentation. Hrsg.: Komitee Terminologie u. Sprachfragen der Deutschen Gesellschaft für Dokumentation. München, Verlag Dokumentation 1975

DATA SECURITY

by

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SUMMARY

Maintaining adequate security standards for classified documents in military information systems is of eminent importance. Handling commercially sensitive information requires similar precautions. Basically, there are two approaches to solve these problems:

- to produce and operate a classified database, in which case national and NATO security regulations must be observed in handling documents and the references to these documents,
- or to work with an unclassified database which contains only unclassified information, in which case the references to classified documents have to be kept unclassified.

The paper discusses questions related to preparing unclassified references to classified documents, deals with release procedures, and with problems related to housekeeping problems.

GENERAL SCOPE

This paper covers some of the aspects which a defence documentation and information centre must consider in order to protect its documents and, of course, the references to them, from disclosure to unauthorized persons and/or organizations. It discusses problems in some detail where necessary and appropriate, and it looks at others in more general terms, if security reasons do not permit detailed discussions in an unlimited paper. It does not deal with questions of data protection from undesired data manipulation or destruction, although, especially in a defence environment, these questions are highly relevant, and of paramount importance. They are part of physical security considerations, and many papers have been written on this subject.

Documentation is, of course, not an activity for its own sake — its objective is information. Information defined as reducing uncertainty or transferring knowledge implies action.

But security — in this context — enforces counteraction. The information specialist is interested in disseminating his information, whereas the security officer of an information centre is convinced to have good reasons to protect the same information from transmission. As a compromise, the aim of a defence information service must be to inform its authorized users as comprehensively as possible, but also to shield the available information against unauthorized access and misuse.

As far as security aspects are concerned, two different types of documents must be considered in a defence information system:

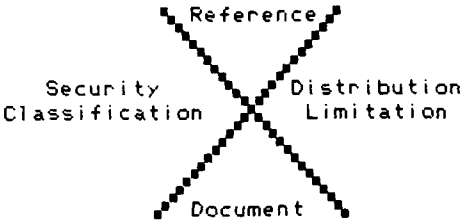
- Classified documents, i.e. documents which bear a national or international security classification, therefore require special protection and need extra treatment, and
- Documents which contain commercially sensitive information, have a distribution statement, and therefore need a similar treatment.

I shall deal with the two types, referring to them as 'classified documents' and 'documents in confidence' (the latter term is supposed to cover the variety of this species). It will be worth-while to devote a few thoughts to a third category of documents as well: NATO Unclassified documents, which will undoubtedly be found in any defence information system of the Alliance.

If we consider the usual type of information service which maintains a referral-type data base (and that is the type of system we are looking at) we have to think of two more facets of security protection:

- Protection of the document itself and prevention of the unwanted disclosure of its contents, and
- Protection of even the reference to the document, where appropriate.

Our problems might be looked at as shown in the drawing below:



By looking at the combination of the adjacent fields, we identify four different problem areas: References with security classifications, and with distribution limitations, as well as documents with the same two restrictions. The resulting four cases need to be looked at separately.

PERSONNEL SECURITY AND PHYSICAL SECURITY

Prior to considering detailed procedures on the handling of classified documents in an information system let us go back to some basics: It is essential that all personnel within an information system, whose duties necessitate access to classified information, need adequate security clearance. This definitely applies to registry staff, indexers, and the personnel concerned with the storage of classified documents. It may also be necessary for typists, data entry personnel and personnel dealing with the information retrieval in case of using classified data bases. You may also need properly cleared personnel within your reprographic services. Considering a military organization, actually all personnel working within the centre should be cleared to the appropriate security level. The 'authority to know', however, should be granted only to persons actually handling classified material.

National regulations cover these questions of personnel security, relating to the basic principles and standards laid down in NATO document C-M(55)15, "Security Within the North Atlantic Treaty Organization" (1). There is no need to go into further details.

The principal requirements for physical security (secure areas, control of entry, strong rooms, security containers, locks) are also laid down in the aforementioned NATO document. They, too, have been specified in national regulations in great detail. The main aspects, as far as the scope of this paper is concerned, are building security, secure store room facilities for classified documents and adequate procedures for transmitting classified information.

CLASSIFIED DOCUMENTS

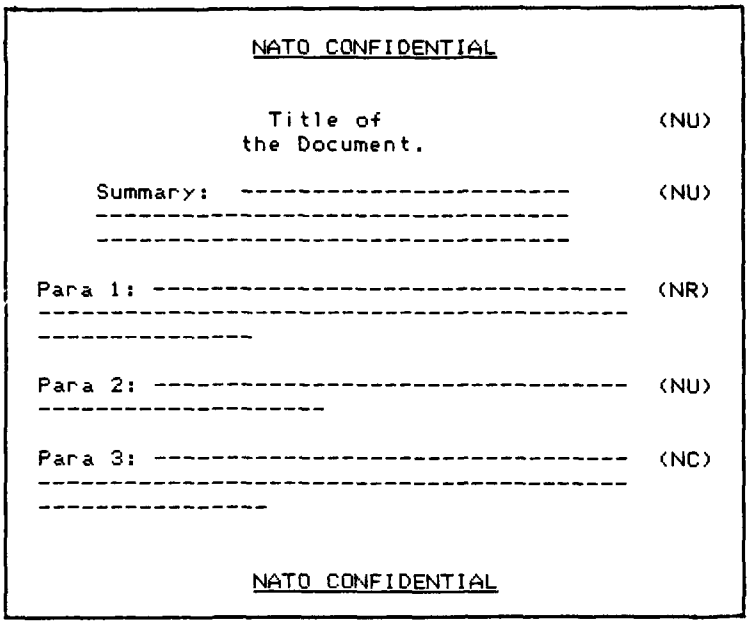
Up to now, the term 'classified document' has been used without further explanation. Classified documents (or classified data, if we think of classified references to classified documents) contain information, the unauthorized disclosure of which would result in serious damage to the originating country or, at least, would be undesirable to its interests. For NATO documents, four security classifications have been defined, expressing gradual differences in the damage assessment in the case of an unauthorized disclosure. National regulations may differ slightly, but generally follow these outlines.

Classified documents bear an appropriate security marking according to their contents. In the case of NATO documents these markings are

NATO RESTRICTED
NATO CONFIDENTIAL
NATO SECRET
COSMIC TOP SECRET

in ascending sequence. Appendix 1, extracted from an AGARD paper on the same subject (2), gives a side-by-side listing of NATO and national security gradings.

To ensure accurate and precious security markings, NATO regulations call for individual marking of clearly identifiable parts of complex documents, if they are of various levels of classification, or of no classification at all. Thus, a NATO document, bearing information which has been assessed as NATO SECRET and therefore been marked 'NATO SECRET' as a whole, may well have an unclassified title, followed by an unclassified summary, several paragraphs marked 'NATO RESTRICTED' or 'NATO CONFIDENTIAL', and annexes or appendices of different security gradings. The sample below shows a NATO CONFIDENTIAL document with both an unclassified title and abstract, a first paragraph being NATO Restricted, a second one NATO Unclassified, and a third one being NATO Confidential:



This procedure has shown to be extremely helpful in the documentation process. Unfortunately, corresponding regulations have not been included in the national regulations of all of the NATO countries.

Access to classified information is confined to people whose duties make such access essential. The classical 'need-to-know-principle', laid down in NATO regulations and utilized in all NATO nations, governs access to classified information. Rank, appointment, and security clearance will not merit access without the need-to-know.

If there are quite a few inconveniences involved in handling classified documents (their proper handling requires extreme caution, specially trained staff, and the observance of numerous regulations), why do we want to include them in our information system? There are good reasons to undergo all this trouble, because

- classified documents most likely contain very valuable information,
- the initial distribution of classified documents is normally limited to a few recipients only,
- knowledge of the existence of classified documents is not available to people who might have a need-to-know in the future.

These three reasons are well supported by the results of the study on the "Use and Value of the Defense Technical Information Center Products and Services" in 1983 (3). Observing adequate security standards, a defence information system definitely must include classified documents in its holdings and make this information available to its authorized users, whenever it is appropriate.

CLASSIFIED OR UNCLASSIFIED DATA BASE

The answer to the question as to how to proceed when incorporating classified documents in the holdings of a defence information system, depends totally upon the decision whether you want to operate a classified data base or whether you prefer to stick to an unclassified one. If full text storage of your documents is intended, this decision is obviously predetermined. But if you prefer to operate the usual referral type database, whereby you store a reference (a substitute) for each document, this decision must be taken.

If it has been decided to operate a classified data base, triple security arrangements should be guaranteed: conventional arrangements, conceptual precautions, and data-processing provisions. Conventional arrangements include infrastructural concepts for the data processing areas, entry control to them, and other aspects of physical security. Conceptual precautions have to be part of the overall system layout. The necessary provisions for electronic data processing range from reliable procedures for user identification, a positive authorization for the access to the data base (or part of it), granting authority to carry out searches, giving the authority to see all or only part of the references, and permitting a print-out of the results. Depending upon whether searches are carried out only by personnel within the physical area of the centre or by searchers from outside there may be the need for safe transmission lines and cryptographic equipment. All these elements must be well coordinated and must complement each other (4).

The decision for the operation of a classified data base is not only a question of technical realization, of convenience for the user, and of expenditure of work for the system personnel. Operating costs for both alternatives must be evaluated, and considered for the long-term operation of the system.

Of course there are — as in most cases — some suitable 'as-well-as' solutions: You may think of a data base containing classified and unclassified references. Access to the classified references may be restricted to terminals within the centre, whilst only unclassified information is accessible through remote terminals from outside. In this case searches for classified references must be carried out by personnel of the centre. Identified infomation may be screened properly and checked against the need-to-know of the user prior to dispatch. Or a well defined user community might access such a data base via dedicated lines and have access to all references, unclassified and classified, whilst other users — through their dial-up capabilities — get only access to the unclassified references (5).

If the decision for an unclassified data base is taken, the problem of incorporating classified documents in the holdings of the centre concentrates on the question, how to produce an unclassified substitute for a classified document in order to keep the data base unclassified.

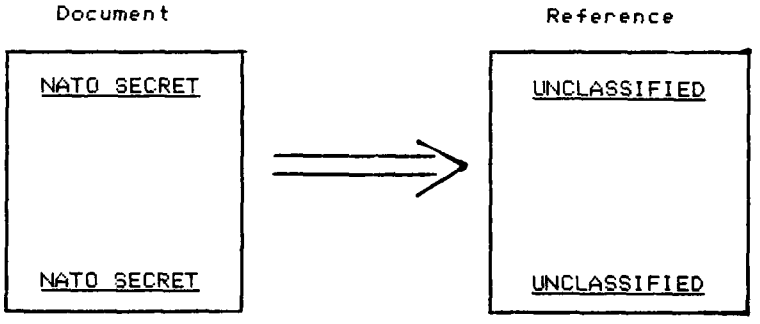
UNCLASSIFIED REFERENCES TO CLASSIFIED DOCUMENTS

There are certainly several ways to produce an unclassified reference to a classified document. The following procedure is one possible method, the method we use in the Federal Armed Forces. This applies only to 'Confidential' and 'Secret' documents. Documents classified 'TOP SECRET' are excluded from documentation. I understand that this applies to information systems of other NATO nations as well.

The substitute for any document — whether unclassified or classified — must feature enough details to allow a succesful search for the document. And it must express enough information for the user decision to order the document, if the user needs it. So the reference will include at least the originator of the document, the document title, pertinent bibliographic details (date of origination, length of the document, language, country of origin), and possibly an abstract. The preceding paper covered these principal facts in great detail. For our security considerations, the reference as a whole must be unclassified.

Most suitable to observe this security aspect is — of course — the author of the document himself. If he provides an unclassified substitute together with the classified document, there are certainly no problems in the further processing. Therefore, in our system, classified documents are practically documented by the authors, and the system personnel is obliged to control their work, look especially after index terms and bibliographic details. If this procedure, whereby unclassified substitutes are to be delivered by the authors/originators, cannot be enforced, things become much more difficult.

If the classified document bears individual security markings for — let's say — the title and a summary, and both of them happen to be unclassified, there is normally no problem for an indexer to produce the required unclassified reference. If, however, these clues are not forwarded by the author/originator, the indexer has to be most careful not to include details in his reference which might contain classified information.It takes sound knowledge, though, to decide, for example, whether the inclusion of the frequency band of a radar set in the title makes this title classified or not. If there is doubt about it, there is in many cases no way but to check with the author. If the title contains classified information, it must be altered accordingly to a 'fake title'.



The same applies to the abstract produced from a summary provided by the author. The indexer will principally give as much information as possible without disclosing any classified information. Therefore, the unclassified abstract relating to a classified document will in most cases be of a more general nature, will use an indicative style, omit giving facts and results. Indexing normally causes no extra difficulties.

Whether to quote the security marking of the document in the reference to it in clear-cut terms or in code must be considered as well. It is essential, however, that an appropriate marking is included. This facilitates the exclusion of all references to classified documents in file searches, if so desired.

This procedure, described in some detail, is well within security regulations. NATO security regulations state quite clearly that 'references to classified documents will not be classified unless the reference itself contains or reveals classified information'. If national regulations approve of this principle, there is no reason not to follow on these lines.

USE OF UNCLASSIFIED REFERENCES

In principle, there are no restrictions in using unclassified references to classified documents in unclassified bibliographies or abstracting journals, However, it is well worth considering either a controlled distribution of these listings, limited to a well-defined user group, or to give them an appropraite security grading. The question whether to disclose the security classification of classified documents to the user or not is of practical importance and should be well considered. Not revealing it, may lead to document orders by users not having the required need-to-know. These requests evoke administrative efforts, and cause indignation with the user after refusal. Disclosing it, on the other hand, might be considered an unnecessary security risk.

In the Federal Armed Forces Defence Documentation and Technical Information System, at present, only (unclassified) references to classified STC documents (documents, originated by the SHAPE Technical Centre) are included in our abstracting journals. These references are identifiable by insiders of the system as references to classified documents. The user normally does not recognize this fact. The unclassified abstracting journals are distributed to a well defined user group within our armed forces, some copies also reaching defence contractors and other non-military agencies.

In our retrieval system, normally references relating to classified documents are included in the printouts of online searches. Naturally, they may be excluded, if so desired. Here, once more, the question of a security risk might come up, especially if an online-community situated outside the centre is connected to the system and carries out subject searches. The responsibility for including or excluding references to classified documents must be clearly defined. The user, again, is normally not aware of the fact, that certain references refer to classified documents.

Another approach to the same problem is to include the references to classified documents in the printed result of the search originated within the information centre only, but not to display the substitutes on the display units outside of the centre. Thus any result, including references to classified information, may be checked, before it is made available to the (known) user with the appropriate need-to-know. And, on the other hand, references to classified documents are concealed from any intermediary without proper need-to-know.

DOCUMENT STORAGE AND DELIVERY

Due to their sensitivity, classified documents will be held in a special collection. They will normally be stored in strong rooms under the control of the security officer and his staff. NATO and national regulations describe in great detail the specifications and rules which must be observed in the day-to-day administration of these documents. Questions dealing with the registration of classified documents, document control, inspections, and supervision are not part of this paper.

The two interesting questions here are:

- How is the need-to-know ascertained?
- How are classified documents delivered to the user?

In most cases, users ordering classified documents are military organisations (Headquarters, branches of the Ministry of Defence, for example). But in many cases, defence contractors, i.e. civil institutions, require classified information for their work. For all these users, the need-to-know must be ascertained. The safest way to do this is to refer each request to the originator of the document and ask for his approval. This, of course, causes considerable administrative efforts within the centre. Furthermore, a noticeable delay in the delivery of the requested document will be experienced. Not to mention the problems which are encountered when asking for the release of older documents (the originating agency will hardly remember what the contents of the document really are) or when trying to get a release for a document the originator of which cannot be traced due to staff reorganization.

In case of the Federal Armed Forces Documentation and Technical Information System, classified documents, with only very few exceptions, are not held in the document collection of the information centre. Classified documents are stored in the classified registry area of the document producers, or, in case of documents originated from outside the Bundeswehr, in certain defined registries. Thus, document requests are transferred to these organizations, and it is their responsibility to ascertain the need-to-know, and to provide the document to the user, if feasible.

This regulation practically reduces the responsibility of the information centre for providing classified information to the user. The information system is merely responsible for providing the references, and it has no influence on the delivery of the documents. Seen from the security point of view, it is probably the best procedure. Seen with the eyes of an information specialist, it constitutes a user-unfriendly reduction in the services of the information centre.

Prior to this rigid reglation, the Head of the our information centre had been granted authority to release classified documents to military users, i.e. to establish the need-to-know in these cases. The high responsibility was well acknowledged. The signature of the commanding officer of the requesting military agency and the rigid transfer procedures through special registries guaranteed the necessary security. For all other users, namely for the defence contractors, the need-to-know has to be ascertained by the originating agency of the respective document. If the document had been produced under contract by a

civilian institution, say an industrial corporation or a research institute, as is very often the case with technical report literature, responsibility was with the Ministry of Defence Staff Branch previously responsible for the conduct of the contract. This procedure worked well, and in 25 years of operation, no security incident had to be reported.

Whether a classified document is given to the user for a certain period of time or whether a copy is produced and sent to him for retention is mainly a question of practical consideration. From the security point of view, each extra copy of a classified document constitutes an additional security risk. On the other hand, if the only copy of a document held by the centre has been lent, and the document is needed urgently by another user, a fast call back for the document might cause quite some trouble.

Producing copies of classified documents is permissible. Pertinent conditions and procedures are laid down in NATO and national security regulations. The same applies to the transmission of classified document. Classified documents must be transferred through registry channels using courier services wherever possible. Records are kept in accordance with regulations. So utmost control is exercised.

NATO UNCLASSIFIED DOCUMENTS

Before leaving the problems related with the handling of classified documents in an information system, a few words about NATO UNCLASSIFIED documents. Documents marked "NATO UNCLASSIFIED" do not require security protection. They are not 'classified'. Nevertheless, they are to be released to non-NATO nations, organizations, and individuals only when such a release would not be against the interests of the Alliance. The word 'NATO' is a marking which signifies that the document is the property of NATO.

NATO:
This document is property of NATO

UNCLASSIFIED:
No security protection required. Check carefully prior release.

So, a document bearing the marking 'NATO UNCLASSIFIED' is not to be given to everybody without proper consideration. The above-mentioned principle applies.

DOCUMENTS IN CONFIDENCE

Apart from classified documents, a defence information centre receives many documents from various sources which also need special handling and protection. The main source for these documents are the defence contractors. Contractors carry out research studies on behalf of the Ministry of Defence. The results of these studies, for example technical reports, contain technical know-how and scientific findings. If such a report does not have any security implication, it does not carry a security classification, of course. Nevertheless, the information might be of high interest to a competitor because of its commercial value. Such knowledge might save years of research efforts and therefore much money. Proper handling of this type of documents requires practicable procedures, and a well trained staff.

Special care must be exercised if documents containing 'proprietary technical information' have been received from another nation. The NATO agreement on the communication of technical information for defence purposes (6) states:

> "When for defence purposes, technical information is communicated by a government or organization of origin, to one or more recipients as proprietary technical information, each recipient shall (...) be responsible for safeguarding this information which has been disclosed in confidence. The recipient shall treat this technical information in accordance with any conditions imposed and take appropriate steps compatible with these conditions to prevent this information from being communicated to anyone, published or used without authorisation or treated in any other manner likely to cause damage to the owner."

And the implementing procedures (7) specify:

> "All communications of technical information under the Agreement are made for information purposes only unless express consent is given to the contrary. The term 'for information purposes' in these procedures means for purposes of assisting in the evaluation of the technical information for defence interests only and without prejudice to any rights of the owner. This term does not include the use, duplication or disclosure, in whole or in part, for purposes of manufacture."

To protect such information from disclosure to unauthorized persons or organizations, a distribution statement is placed on each document. This statement advises the centre on the conditions under which the document might be released to the users. Distribution statements may be applied to classified documents as well. In such a case, both restrictions for the release of the document must be observed.

UNCLASSIFIED OR UNLIMITED?

Security classification and distribution statement serve the same purpose: to protect the contents of a document from disclosure to unauthorized users. A classified document automatically enforces a limited distribution, limited namely to persons with the necessary need-to-know. But an 'unclassified' document is not automatically suitable for an 'unlimited' distribution. A few lines quoted from DRIC Leaflet No.8 (DRIC = Defence Research Information Centre) will clarify the relation between these two terms (8):

> "In Defence circles, if a document is not marked RESTRICTED or above, then it is UNCLASSIFIED; there is no lower security classification. Although UNLIMITED is often indicated as a security marking, it is strictly a distribution statement, and indicates that an UNCLASSIFIED document has been approved for release to the public. This includes the British Library Document Supply Centre, UK copyright libraries, and certain overseas agencies... To warrant UNLIMITED distribution the document must conform to certain criteria. For example it must contain no matter which is objectionable on grounds such as policy, commercial security or adverse comment on commercial products. It must be clearly marked as being openly available, or bear a purchase price and have no restrictive marking.
>
> To sum up, an UNLIMITED reports must be positively identified (and marked) as such or bear a clear indication that it is suitable for public release; all other UNCLASSIFIED reports must be treated as documents with limitations on their distribution."

Security classification and distribution statement are two distinct matters. They exist side by side and complement each other, although the term 'UNLIMITED' is often used on its own, as it necessarily implies UNCLASSIFIED.

HANDLING OF DOCUMENTS WITH DISTRIBUTION LIMITATIONS

In contrast to the explicit and detailed security regulations for the handling of classified documents, the procedures for the management of documents with distribution limitations are less standardized. They differ from country to country, and in many cases the text of the limiting remarks requires an interpretation.

The high reponsibility which has been entrusted to the information system requires adequate handling of these documents to ensure proper protection. In case of a violation of the entrusted privacy, the financial damage might well be burdened upon the responsibility of the centre. Moreover, the lasting distrust caused by such an incident might lead to the refusal to provide such valuable documents to the centre in the future.

To ensure proper management of documents which contain commercially sensitive information, it is up to the policy makers to promulgate unmistakable procedures. It is the responsibility of the centre to comply with them, to protect vital information from disclosure to unauthorized persons and/or organizations, but to guarantee full and comprehensive information to all authorized users.

Two examples will illustrate the variety of documents with distribution statements and their proper handling by an information centre. Both are fake examples, however they show the day-to-day praxis:

(1) A document bearing the security marking 'VS — Nur für den Dienstgebrauch' (the German equivalent to NATO Restricted) carries the additional distribution statement 'Friegegeben für Bundeswehr und Bundesbehörden. Freigabe andere durch .....' (document may be given to all Bundeswehr units and official agencies of the Federal Republic. For other recipients, permission must be obtained by .....).

In this case, certain users, as specified above, may get the document on discretion of the centre, while for other users permission must be obtained by the authority nominated in the statement.

(2) A report bearing no security classification and thus being 'unclassified' (in Germany, we do not apply the marking 'unclassified' to such documents) carries the distribution statement 'Freigabe nur durch BMVg ....' (to be released only by MOD....).

In this case, authority must be obtained prior to release of the document in any case, irrespective of the user requesting the document.

For practical purposes, it is very useful to have an appropriate entry in the references, indicating whether a document may be released to all users or whether a distribution statement limits its distribution. Thus, documents with limited distribution may be excluded from line searches, if so desired. Another question is whether to include documents with rigid distribution limitations in bibliographies. Disclosure of the reference to a document bearing a distribution statement — even to persons who would not receive the document upon request — generally causes no damage. Nevertheless, it must be kept in mind that these documents have been entrusted to the centre in confidence.

One problem is the standardization and proper definition of limiting remarks. If documents are received from foreign countries all restrictive remarks must be transferred and converted to the appropriate national ones. Extreme caution must be

exercised not to misinterpret them or change their meaning. International cooperation, on a case by case basis or under a bilateral agreement, will only continue and progress if the delivering country can be sure that all conditions under which documents have been given or exchanged are strictly observed by the receiving country.

It is most important that distribution limitations are clearly stated on the documents, and that the user understands under which conditions and for what specific purpose documents have been made available to him. He must acknowledge that it is his responsibility to use the information for this specific purpose, and it is his responsibility, too, that the information is not misused by himself or by others.

Storage and delivery of documents with distribution limitations cause no special problems. However, it is essential to keep accurate records on each document. It must be realized that the administrative effort in handling such documents is considerable, requires knowledgeable and well-trained staff.

HOUSEKEEPING

The level of protection which is required for classified documents usually falls as time goes by. Limited reports often need no special protection after some years and are then made available to the public, and documents may become obsolete or outdated. So, classified documents may have to be downgraded to a lower security classification, or even declassified, as the case may be. Distribution limitations may have to be altered or eliminated. Obsolete documents may have to be destroyed. It is in the interest of the information centre and of its users that the holdings of the centre represent the actual status of the security level of the documents, that outdated distribution limitations are cancelled, and that obsolete documents are eliminated. Therefore, in spite of staff shortages, these tasks must be undertaken regularly.

To do this it is essential to get reliable notice from the originators of the documents if any such actions are required. Agencies issuing numerous documents will probably check their issues once per year and notify all recipients on the actions required. Others may prefer to inform the centre in each individual case. If an automatic downgrading procedure has been incorporated for certain documents by the originator, stating that the document shall be downgraded after a certain period of time, it is up to the centre to keep track of this date. In addition, it is essential to check the holdings of classified documents of the centre regularly and request permission for number of documents to be checked and upon the personnel which can be made available for such actions. If copies of documents which are up for downgrading or declassification have been distributed to users for retention it is the responsibility of the centre to inform these users accordingly.

By downgrading documents, the old security classification will be lined through and the new classification will be shown on the document. A similar procedure applies if classified documents become declassified. NATO and national security regulations cover all necessary detail. If documents which originally bear distribution limitations, become available for unlimited distribution this must be clearly stated on the respective documents. Of course, all references in the data bases must be altered accordingly, too.

If classified documents are to be destroyed because they are outdated or obsolete, their destruction must be executed in accordance with security regulations. The destruction of obsolete documents in confidence requires also some precautions. Superfluous to note that references to such documents must be eliminated, too.

CONCLUSION

Classified documents and documents in confidence contain valuable information. The originator has entrusted this information to the information centre relying on the proper handling they require due to security aspects or commercial sensitivity. Both types of documents need careful treatment. It is essential to have adequate procedures, definite instructions, and well-trained staff for their management.

REFERENCES

(1) *Security Within the North Atlantic Treaty Organization.* Document C-M(55)15(Final). Vol.I, NATO Restricted.

(2) Helmut Braun. *Security Considerations — Defence-related and Commercial.* AGARD-CP-416, 1987.

(3) Nancy K.Roderer, Donald W.King and Sandra E.Brouard. *The Use and Value of Defense Technical Information Center Products and Services.* King Research, Inc., Rockville, Maryland, 1983.

(4) Bundesministerium für Forschung und Technologie. *Concept of a Secure Information System Consisting of the Components Operating System, Database, Dialogue-System, and Applications.* BMFFT-FB-DV 83-005, 1983 (in German).

(5) *Handbook for Users of the Defense Technical Information Center.* DLAH 4185.8, Defense Technical Information Center, Defennse Logistics Agency, Cameron Station, Alexandria, VA, 1985.

(6) *NATO Agreement on the Communication of Technical Information for Defence Purposes.* BGB Teil II, Nr.39, p.985 ff, 1973.

(7) *Implementing Procedures for the NATO Agreement on the Communication of Technical Infomation for Defence Purposes.* ibid, p.993 ff.

(8) DRIC Leaflet No.8 (Issued June 1986), *Unclassified or Unlimited?.* Defence Research Information Centre, Glasgow.

Appendix I

Side by Side Listing of Military Security Categories

NATO	COSMIC TOP SECRET	NATO SECRET	NATO CONFIDENTIAL	NATO RESTRICTED
BELGIUM	TRES SECRET	SECRET	CONFIDENTIEL	DIFFUSION RESTREINTE
CANADA	TOP SECRET	SECRET	CONFIDENTIAL	RESTRICTED
DENMARK	YDERST HEMMELIGT	HEMMELIGT	FORTOLIGT	TIL TJENESTEBRUG
FRANCE	TRES SECRET	SECRET-DEFENSE	CONFIDENTIEL-DEFENSE	DIFFUSION RESTREINTE
GERMANY	STRENG GEHEIM	GEHEIM	VS-VERTRAULICH	VS-NUR FUR DEN DIENSTGEBRAUCH
GREECE	AKROS APORRITON	APORRITON	EMPISTEFTIKON	PERIORISMENIC CHRISSEOS
ITALY	SEGRETISSIMO	SEGRETO	RISERVATISSIMO	RISERVATO
LUXEMBOURG	COSMIC TRES SECRET	SECRET	CONFIDENTIEL	DIFFUSION RESTREINTE
NETHERLANDS	ZEER GEHEIM	GEHEIM	CONFIDENTIEEL OR VERTROUWELIJK	DIENSTGEHEIM
NORWAY	STRENGT HEMMELIG	HEMMELIG	CONFIDENSIELT	BEGRENSET
PORTUGAL	MUITO SECRETO	SECRETO	CONFICENCIAL	RESERVADO
TURKEY	COK GIZLI	GIZLI	OZEL	HIZMETE OZEL
UNITED KINGDOM	TOP SECRET	SECRET	CONFIDENTIAL	RESTRICTED
UNITED STATES	TOP SECRET	SECRET	CONFIDENTIAL	———

IDENTIFYING USERS AND HOW TO REACH THEM

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Summary

The importance of timely use of scientific and technical information is increasingly being recognized by the developing nations as well as the developed nations. They recognize that it is not only important to develop a better mouse-trap but also it is equally important to ascertain that there is proper diffusion of such an innovation. Knowledge could lay dormant if it does not reach the end-users when they most need it. This paper attempts to address why this is important and focuses on some of the factors involved in identifying and reaching the end-users.

Introduction

As separate nations we have progressed a long way from our common roots as agrarian societies. Those nations that developed strong agricultural economies influenced much of the later direction towards industrial growth and trade. Among these nations, the most successful ones have also played decisive roles in the dawning of today's post-industrial era, which has rapidly become known as the information revolution era.

More than ever before, we seem to not only produce and consume large quantities of agricultural and industrial goods, but also generate and use large amounts of information and information-related products. How we choose to handle this information can play a significant role in today's socio-technico-economic environment. More importantly, our decisions can determine which nations will be the successful and trend-setter nations when we enter a new century.

There is an interesting parallel between today's information products and the more familiar agricultural and industrial products. Some information products, like some agricultural goods, are "perishable" - that is, they become less valuable if not used immediately, and even become worthless if left too long. And some information products, like some industrial tools, can be used over and over again, and can provide synergistic effects when mixed with other products. Today, a whole new information economy is developing to assuage the growing needs of all nations - both developed and developing.

The Issue

For the information economy to thrive and prosper, database producers and distributors need to identify and reach the individuals and groups of consumers that depend, or could depend on their products. It is also essential for information distributors to foster the relationship once contact is made. Consumers need to be convinced in their own minds that their needs, real or otherwise, will be met. We are now talking about a match, real or perceived. A fit must exist on a continual basis between those who provide information and those who use information.

Unlike other commodities, information is a unique product. It can be a starting material, an intermediate ingredient, or could well be the end product. And because information can mean different things to different individuals, how they use it depends upon how they interpret what they receive.

Information use depends upon the users' own knowledge base. Their use of information defines where they are coming from and where they intend to go. Before information can be used, however, the information must fit each individual user's unique needs, otherwise knowledge could lay fallow.

Information production, on the other hand, is a result of the cognitive exercise of the authors. Since the producers (authors) and users (intermediaries and end-users) of information are many and unique individuals with different goals and objectives, the match between the users' expectations and what is provided must be satisfactory. It is here that value-added packaging, presentation, and marketing plays a vital role in attracting and satisfying customers.

Only satisfied and contented customers will tend to use particular information packages repeatedly. And, as with any product or service, customer satisfaction tends to bring new customers as well as repeat customers. Thus, information marketers - database producers and distributors - face a challenging situation that is the product they create must in fact be the product that the users seek or might seek. To date this has been a guessing game. But now, more than ever, the need to match or

create a better fit between information producers, providers, and users is absolutely compelling.

For technology transfer to happen, the right information must be made available through all the various stages of research and development. The ability to accurately foretell expressed and unexpressed information needs of the users is the key to an effective technology transfer mechanism.

Concern

Effective use of information in all branches of science, as we all know, can play a crucial role in improving the economics of those nations that successfully use such available information to the fullest extent possible. In the United States, Executive Order 12591, "Facilitating Access to Science and Technology," echoes this fact. And, more recently, President Reagan in his welcoming address to the International Technology Transfer Society Symposium said, "I encourage the transfer of scientific and technological research to the private sector." One good example of how technology transfer can impact a nation is through patent acquisitions. For example, the successful filing and acquisition of a patent in one country is followed by application for equivalent patents in strategically important countries. Such a move could prevent others, corporations and nations alike, from legally producing that product or using that concept in a similar manner. Here, the implications could be far reaching from the simple lack in economic growth and development to possible restriction of use of such products which could be crucially important in national emergencies. Generally, patent acquisition is a precursor to industrial production. It plays a significant role in the technology transfer process. Our efforts should focus on providing all available information to the scientist and engineer, regardless of the vehicle of communication.

Challenge

Communication has been recognized as the essence of science, and scientists, it appears, have an insatiable need to communicate. For science and technology information marketers and users, the challenge is immense because increasingly more STI is being published outside of NATO countries at a growing rate and in many languages.

As information providers we are faced with acquiring and packaging all relevant information so that our scientists will have access to all previous and ongoing R & D they need to accomplish their particular research or developmental efforts. We all recognize the importance of such activities nd their effects on product development. We can benefit from any additional resources or political support given to such efforts. For the first time, it appears that one of our member nations, Canada, might formally and officially link the importance of technology transfer to full exploitation of scientific research in a bill, (C128), currently pending in the House of Commons. It is an Act to establish the Department of Industry, Science and Technology, to repeal the Department of Regional Industrial Expansion Act, and to make other consequent amendments to other acts.

If we are to identify and reach all intended audiences, we need to first understand the process of scientific ocmmunication as it exists. What is communication? In the traditional sense communication can be best described by the Shannon and Weaver SMR model as explained four decades ago and represented below:

SENDER	MESSAGE	RECEIVER
(authors or producer)	(findings or product)	(scientist or intermediary)

They (authors, database producers and users) are partners in the labyrinth of scientific information. Today STI findings are communicated in a variety of formats and languages. The number of these publications is increasing by a factor of 10 every 50 years (Price, 1961). Although the exact number of scientific and technical publications worldwide is difficult to establish, some have estimated these to exceed more than 100,000 (Swanson, 1952). Interestingly, while the total number of publications has drastically increased, the ratio of scientists to the number of publications they produce has remained fairly constant over the centuries (Bar-Hillel, 1963).

If NATO nations are to remain a dominant economic and political force in the world, our scientists, engineers, and decision makers must strive to fully capitalize upon existing research results. A significant part of this effort involves successful communication among scientists. Emphasizing this notion, a U.S. National Academy of Science report said, "how to communicate and use scientific information has been a serious concern to both government and private organizations."

It is precisely this issue that we are now addressing. Scientists, it appears, tend to have a "strong urge to write, but a mild one to read" (Price, 1963). This was well documented by Merton (1968), who showed that in the field of chemistry only about 0.5% of articles published in journals were actually read. This is an alarming statistic, which further underscores the importance of providing the right information

in the right format and to the right sources.

As database producers and information intermediaries we have no direct control over what is said in scientific writings. We can, however, have an impact on the identification, retrieval, and use of such information. In doing so, we exert indirect control over what is expressed by the information producers and the information users. Let us examine both, the information user and the information producer.

The Information User and Producer

From the scientific and technical perspective, who are the information users and what are their needs? It depends on how you view them (Slide 2). From a narrow organizational perspective, users can be classified as those who do (the actors) and those who delegate (the directors). These are the players who make a significant contribution to a particular organization - the individuals who can move the production phase of a product from an evolutionary to revolutionary track. As you can see, while their needs are different, their disciplines could remain the same.

These are the individuals, or groups of individuals towards whom we ought to target our efforts. In this regard, they are a highly selective target group. Though it appears to be a simple group because its members are either scientists or engineers, it can be complex once we examine it closely. The complexity arises because of differences in each group member's job expectations. Whether chemists or engineers, biologists or physicists, each tends to develop a different information-seeking pattern. It is here that understanding the user and his use pattern becomes vital if communication is to have an impact.

Effective communication should not be measured only in sending the right messages, but also in releasing the right responses from the audiences for which it is intended. Some of these right responses ought to result in incorporating to the fullest the results of past research efforts, thus culminating in increased standards of living and greater benefits to mankind. Making a better mouse trap is not sufficient enough - how to make it must be effectively communicated to those how need to make such products. Information producers seldom concern themselves with the logistics of diffusion of information. They are keen on profiting from existing knowledge and building new theories and models. They concern themselves mostly with innovation. Effective diffusion of innovation to appropriate targets is our concern, not the concern of the information producer.

Scientific communication, like the agricultural product talked about earlier, is time-sensitive. It is most effective at the peak of its freshness - when it is communicated to the right audience at the right time and in the right format. The right format inevitably involves repackaging, including translation and added comments - those value-added activities. Translation is emphasized because of the intense research efforts that are ongoing throughout the world, both in NATO and non-NATO countries. To illustrate how necessary translation activities are, scientists in England were surveyed to determine if they had had need for translations of S & T papers they'd recently encountered. Overwhelmingly, 80% of the scientists named at least one S & T publication that they wished they could have had translated. Surprisingly, more than 60% of them also claimed that they had encountered such a need within the previous two months. This need is clearly visible when we examine the abstracting and indexing literature. For example, more than 20% of the abstracts in Chemical Abstracts are in Russian, and more than a third of the source references are non-English sources (Reynolds and Subramanyam, 1983). If we can effectively deliver such information in full text, we can reach larger audiences.

The User Requirements

Information needs of users will change as time progresses, even though they remain in the same subject area. This change reflects the change in their intellectual ability to absorb and interpret data that is presented. The users also mature. Slight changes in their demands might be because they know more today than they did yesterday or a year ago. This is reflected in the questions they ask and the answers they seek. Some have also learned that not only is there more information in diverse formats, but there are novel retrieval techniques that could also be applied.

Reaching The Users

Needs of users are based on what they are expected to accomplish within their organizations. The pressure is on us as information producers, information packagers, and information retrievers to understand the needs of existing and potential users. We need to identify key impact users. They are not seeking more information but the right information at the right time - and on time. Most customer information needs are usually brought up at strategic planning sessions. As information providers who are attentive to our customer's needs, we should attend these meetings as active listeners and passive participants so that we can be more proactive and less reactive to customer information needs.

Understanding the mission of the customer's agency is crucial for data repackaging and delivery. Repackaging may become more important. For all practical purposes, a published paper by itself could be considered as a monologue in the third

person. It contains a message. The message by itself may or may not be valuable. But when combined with other information, the perceived value of that publication could change drastically. We might want to seriously consider linking selective bibliographic databases with numeric databases to meet such needs.

All knowledge must be gathered and properly disseminated because, as famous physicist Lord Rutherford said, "Scientists are not dependent on the ideas of a single man, but on the combined wisdom of thousands of men...."

Scientists and engineers face the problem that while what is produced in terms of relevant information is growing exponentially, the time that is available to them to read the new literature remains fairly constant. As such, they have developed their own hierarchy of information "shopping stops" to solve their information gathering problems. Though the invisible college is still the primary source for information, this invisible college varies greatly from one scientist to another and from one engineer to another.

Specifically, there are a variety of efforts that database producers can make to reach their full audience.

1. Producers can provide specific information in a wide range of retrieval formats. With specialization, scientists tend to look for a variety of formats, and present technology has the capability to satisfy such needs.

2. Producers can work towards standardization between database producers and distributors to assist cross-linkage of databases and provide cross-file searching of both domestic and foreign files. This should ease and reduce protocols in telecommunication systems, increase compatability of hardware, and enhance access to Scientific and Technical Information.

3. Producers can concentrate on current or timely access to information. This involves around-the-clock availability of searching.

4. Producers can deliver sophisticated searching mechanisms beyond straight boolean searching of text. This involves sub-structure searching and structure-activity retrieval, cognitive mapping techniques, full exploitation of citation and co-citation retrieval, and mapping. Citations show links between present research efforts and past findings. Unfortunately, technical reports are not as heavily cited as one would expect and there is no citation database for this important vehicle of communication.

5. Producers can increase validity of data, particularly numeric databases. This issue of validity and reliability is fast becoming a requirement among some key scientists. Lewis Branscomb of IBM, emphasizing this very concept, said, "When accurate and pertinent data are available, work can proceed. When they are not, work must stop...." (Science, 1983.)

Marketing information and information products is also of paramount importance to scientific research and development. Effective marketing mandates understanding users and their behavior. Understanding the users involves appreciating where they are coming from and where they intend to go, including their formal training and their reading habits. Understanding users' behavior involves appreciating where they do their information shopping - that is, do they look for information through trade publications, journals, or gate-keepers.

In conclusion, it needs to be emphasized that there is a paucity of information concerning the information producers and the information users. We need to understand better the underlying factors regarding why information producers produce what they produce and why they publish in a particular format. Simultaneously, we need to comprehend thoroughly the information use patterns of the end-users of information. Armed with this knowledge, we as information handlers should not have any difficulty identifying users and how to reach them.

REFERENCES

Allen, Thomas J., Roles in Technical Communication Networks, Communication Among Scientists and Engineers, Heath Lexington books, Lexington, Massachusetts, 1970.

Bar-Hillel, Yehoshna, Is Information Retrieval Approaching a Crisis? American Documentation, pp. 95-98, 1963.

Branscomb, Lewis M., Improving R & D Productivity: The Federal Role, Science, v. 222, pg. 133, October 14, 1983.

Merton, R. K., The Mathew Effect in Science, Science, pp. 56-63, 1968.

Price, Derek deSolla, Science Since Babylon, New Haven, Connecticut, Yale University Press, 1961.

Reynolds, S. A. and Subramanyam, K., An Entry to Foreign Literature, CHEMTEC, pg. 582, October 1983.

Swanson, Don R., Searching Natural Language Text by Computers, Science, pp. 1099-1104, 1960.

Technology Transfer: The Competitive Edge, XII Annual Meeting and International Symposium of the Technology Transfer Society, Washington, D.C., June 23-25, 1987.

INFORMATION RESOURCES MANAGEMENT

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The transfer of scientific and technical information between and among nations poses increasing challenges because of: (1) larger and larger volumes of data exchanged; (2) the increasing variety of information interchange media; (3) larger and larger numbers of intermediaries and end-users all along the information transfer chain; and (4) increasing incompatibility of bibliographic and telecommunications formatting conventions.

The newly emerging field of Information Resources Management (IRM) offers promise in helping to cope with these serious information exchange challenges. In particular, new experiments in the US. Federal Government with a technique called "information mapping," helps information managers identify, describe, inventory/survey, and control their total data, document, and literature flows and holdings, whether automated or manual, more completely.

This paper introduces this new approach of IRM, and the technique of information mapping, in several organizational contexts - one private (an Australian mineral and mining company), the other public (the U.S. Department of State).

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ORIGINS OF THE IRM CONCEPT

It is difficult to trace with any accuracy the origins of the Information Resources Management concept; certainly no single individual, nor single organization can be credited with originating the idea and developing it fully. Many authors trace its emergence to several factors which seemed to converge during the mid-seventies.

The first of these causative factors had to do with the data, document, and knowledge explosion. A number of historians specializing in the history of science and science information such as Derek da Solla Price found that the formal literature base during the second quarter of the Twentieth Century began do move from an arithmetic to an exponential curve. A close corollary of this finding was that the number of scientists and technicians also began multiplying much faster during this same period. Their products were two-fold: man-made artifacts, inventions, new processes, and so on, on theone hand, and new knowledge on the other. How to cope with this rising flood of knowledge and information poses, in essence, and information management problem.

The second of these causative factors had to do with the dilemma that has always been with Mankind, but not ameliorated by the knowledge explosion, and that is that decision-makers and problem-solvers, despite the glut of data, still did not have the information they needed. This problem has been articulated in many forms. One of them is the rather cynical observation: "data, data, everywhere, but never a drop of information to drink."

A third factor has to do with the problem of results from available information. Again, despite the enormous quantities of new knowledge and information, users did not seem to be getting results from the use of the information that was commensurate with the time and expense involved in planning for its creation or acquisition, building the information systems and architectures, buying all of the hardware and software needed to store and manipulate it, and so on. If one visualizes a Venn type diagram with three overlapping circles, this factor might be visually demonstrated by noting that much information is created or acquired, but less -- much less - - is used. And of that quantity that is used, a very small amount is of value.

A fourth factor has to do with the divergence of information handling technologies as a necessary evil, if you will, of the computer and telecommunications revolutions. Despite the enormous strides in the development of ever more powerful, and ever cheaper microprocessors and other information handling and storage technologies, increasingly end-users had to cope with a kind of information technology tower of Babel. I'm fairly certain everyone in this audience has had at least one unpleasant experience in trying to convert from one system, one software package, one piece of hardware, to another.

And finally, the fifth factor has to do with the organizational and management problem inherent in the question: "Who is in charge of all of the organization's information resources? Is there a single, high level, responsible official whom the top executive can hold at least partially accountable for the efficient and effective husbanding of the organization's total information resources? In short, is there a vice president for information resources, just as there is a vice president for financial resources, another for human resources, and a third for physical resources? Until very recently, the answer has been "no."

These five major factors, and some others, taken together, seem to account for why and how the Information Resources Management idea has come about. But there has been considerable disagreement and debate on how to move forward with the concept.

PROBLEMS WITH IMPLEMENTING THE CONCEPT

The first problem faced by implementors of the concept is that the resource itself, information, is substantially different from the traditional organizational resources of men, money, and material. And these differences have defied the application of traditional economic, accounting, and other methods of valuing, costing, and pricing information products and services, both internally within organizations as part of the transfer pricing problem, and externally in selling those products and services in a marketplace.

The second problem faced by implementors deals with trying to integrate the various information handling disciplines into a single, cohesive information management structure. When one considers that the fields of archives and records management, libraries, automatic data processing, statistics, scientific and technical information, and many more, each has its own unique perspectives, tools, approaches, and knowledge and skill requirements, it isn't any wonder that many organizations have stumbled on the shoals of trying to bring such diverse groups together under the same organizational umbrella.

A third problem has to do with the question of turf and organizational power. It is a rare organization that hasn't had to deal with the problem of how to smooth the feathers of General Smith, in charge or computers, and General Jones, in charge of Communications. Neither, understandably, wants to give up turf or power. And yet, implicitly, the IRM concept has been that a single, high level official is supposed to have the information handling functions reporting to him or her.

A fourth problem deals with the difficulty in developing a meaningful body of doctrine that would make IRM more than a passing fad, like the latest "management gimmick." While it is easy to say "we should manage information as an organizational resource," it is far more difficult to answer the question "how do we do it?" I will later discuss what I believe one emerging approach, information mapping, can do to deal with this problem.

WHERE DOES THE CONCEPT STAND NOW?

If we look in the United States at the Federal Government, because of a key law passed by the U.S. Congress in 1980 called the Paperwork Reduction Act, every Federal agency has an IRM establishment of some kind, headed by a single official who in turn reports to the agency head. But no two IRM units are configured exactly alike. As the years have gone by since 1980, some agencies have been notably more successful than others in moving to a truly integrated information management establishment. Others that may have started fast out of the gate have slowed down, and a couple are going in reverse.

Nevertheless, I dare say that the Congress of the United States will not repeal that law, because it would be tantamount to giving up on the information mis-management problem, and no U.S. Congressman wants to report back to his or her constituency back home that he has voted for more government paperwork and its attendant burdens of the public, on businesses, on lower levels of government, and on institutions like hospitals and colleges.

Moreover, the lower levels of U.S. government - - the state and local levels - - are at long last beginning to stir in the IRM direction. Traditionally they take their lead from the Federal sector. But they are slower to accept modern management reforms, and IRM certainly has been no exception.

So, in summary, in the public sector of the United States, I believe IRM will continue to evolve for many years to come. As the information management problem continues to exacerbate, I believe the pressure will increase to deal with the problem as essentially a resource management problem. But we're still hoping, apparently, that there is going to come a technological solution to our information management problems. Frankly, I don't count myself as one of those, and I wouldn't urge any of you to hold your breath waiting for a new piece of hardware or software to save us.

Moving to the U.S. private sector, they have resisted the IRM idea, at least in name at least, because companies hav been fearful its embrace would lead to a stifling of creativity and independence at the working level. Nevertheless, even though you don't see the "IRM label" in companies and on office doors like you do in Washington, D.C., in fact companies have been quietly moving to integrate technologies and mesh their information units together. They just don't want to be seen talking about it, and prefer to use terms like "information systems management," which is a more palatable term.

It's interesting that the so-called Chief Information Officer concept, or the "CIO" is now widely embraced by the private sector, and according to some recent surveys up to a full one third of the Fortune 1000 companies have a CIO even though his title may not be precisely that one. The CIO in the private sector has an even broader management mandate than does the single senior official in the government sector.

In countries other than the United States, there is a very mixed picture. Canada has moved to embrace the IRM idea with much greater fervor than the U.S., although they moved somewhat later. One Canadian company based in Ottawa now has a half dozen contracts with both public and private sector organizations to install IRM.

The United Kingdom has also been much interested in the concept, although it, too,

has been much bothered by the absence of a reliable implementation methodology. Certainly the British have a keen appreciation for the value of information in organizational contexts, and are sensitive to the need to manage it.

The Japanese, some have observed, are a "Knowledge Society" to begin with. They have a special appreciation for the value of information as a less expensive surrogate for more expensive natural resources of which they have been endowed with comparatively few. They are also sensitive to the need to share information between upper and lower organizational levels, even though they have a very structured social hierarchy. However, the position of Chief Information Officer, despite these cultural sensitivies and the predilection to share information, still doesn't appear on their organizational charts.

It would be impossible in our time allotted to move around the world with a country-by-country profile. Suffice it to say that there seems to be a great deal of intrigue with the IRM notion, but, like the U.S. most countries are awaiting the emergence of a tested methodology before they move too far with the idea.

WHERE DOES INFORMATION MAPPING FIT IN?

For a long time IRM practicioners have felt that the key to coming up with an IRM methodology that was truly valuable was the need to integrate the increasing number of incompatible systems into an overall information architecture. But most of the early attempts to do this were based on the old Management Information System or MIS philosophy which holds that the information needs of managers can be pre-determined, and therefore the information needed can be put into a massive MIS data base from which top, middle, and lower level managers could draw. In fact, this has not proven to be the case. Top down, "grand design" management information systems have proven unwieldy, almost impossible to integrate, and far too costly to maintain and support. So instead of building more and bigger information systems, in the United States, at least, we now seem to be moving in the direction of increasing decentralization, and more local data bases with less reliable on the monster central corporate data bases.

Some of the early top-down attempts at building an information architecture looked very much like plumbing or electrical diagrams, with data flow lines running all over the place, and from page to page to page. I think that idea is, by now, virtually totally discredited.

A more fruitful approach, in my view, is to go back to fundamentals. And by that I mean to identify and inventory the information assets an organization currently has and start from there to build an information architecture. After all, if you don't have a baseline, how can you possible build? Where would a house be without its foundation? Where would an inventory manager be if he didn't know what he had in the bins and on the box pallets out in the warehouse? Where would a comptroller be if he didn't know what cash was on hand, what was invested, what was payable, and what was receivable? And where would a vice president for manpower be if he didn't know where the human resources were being deployed, of what kind, at what salary, with what effectiveness?

It is the same, I believe, with information. We must first start with a terrain map of what information resources we have now, where are they, who uses them and for what purposes, whether they are available and accessible, who benefits from their use, what they cost, and so forth.

In 1984 my colleague Cornelius F. Burk, now presently employed by DMR in Ottawa, did such an inventory of the total information assets of an Australian mineral and mining company called CRAE, Ltd. In 1987, I undertook a similar effort with the information resources of the U.S. Department of State.

I should like to orally review with you in the time remaining to me these two real world information mapping examples, and discuss what I believe is an exciting new direction for Information Resources Management, especially in the field of military and aerospace technology.

CRA Exploration Pty. Limited

CRAE manages and conducts exploration for and on behalf of CRA Group's companies, with operations extending throughout Australia, Papua New Guinea, the South Pacific, New Zealand, Southeast Asia, the North and South American continents and Europe. Its efforts are directed to particularly, but not limited to, the search for copper, lead/zinc, nickel, coal, gold, tin, diamonds, and uranium. In the 1982 timeframe in which the information mapping project was carried out, CRAE had a total staff of about 450, primarily geologists, geophysicists, researchers and related support staff such as mineral lease specialists, draftsmen and computer support personnel. Corporate management and administration was provided by a small group headquartered in Melbourne.

The company itself developed key parameters for the survey of its information resources, with the advice of C. F. Burk. These resources included: 20,000 internal reports detailing the results of all past CRAE exploration and related activity; 40,000 internal plan transparencies; 1.5 million geochemical/diamond sampling/drill-hole samples and the related assay values, mineralogical observations, sample site information, and drill logs; data tapes archiving the results of several million line kilometers of airborne geophysical surveys; a comprehensive library of geoscience texts and Mines Department publications and published maps; details of more than 30,000 mineral occurrences throughout

Australasia; summaries of past Australian mineral exploration; and summaries of Australasian petroleum wells.

The principal functions of the CRAE Central Information Service were to: manage the physical information resources that CRAE holds involving the systematic physical storage and/or cataloging of each, as appropriate; provide easy-to-use, reliable referencing systems to gain access to CRAE's information resources; provide electronic files of appropriate data - - e.g. geochemical results, drilling data, etc., to allow ready retrieval and interpretation; update archiving and retrieval systems and identify new information sources to stay abreast of new technology; obtain other information not provided by the above means at the request of district staff; and prepare routine internal reports of companywide activities for distribution to district staff.

A simple matrix was then utilized to position each of some 74 of CRAE's most significant information resources. This is the "information map." The first axis attempts to get at the question of whether the resource is primarily a carrier (media/conduit) of information, or is valued primarily because of its substantive content. The second axis attempts to get at the question of whether the resource is primarily a "functional support tool," or whether it is a "holding" - - a reservoir or pool of information or knowledge which is continually drawn upon for different purposes.

For example, take the information resource "mail service." First, ask yourself the question: Is mail service primarily concerned with media/conduit or with content? Clearly the purpose of mail service is to deliver a message from a sender to a receiver without regard to its content. The postman doesn't need to read the contents of a letter to know to whom he should deliver it, so long as the address is properly typed or written on the envelope. So, we would say the mail service information resource is primarily media/conduit rather than content.

But then we must ask: To what degree is the mail service media/conduit in purpose, versus content? 100%? 50%? 25%? To answer this second question, it's helpful to think of other information resources, for instance, a telephone system.

Next the second spectrum on the mapping grid, functions vs. holdings. This time, ask a different question: Is mail a "permanent asset" (part of our information holdings), or a "transactional instrument" (a function or flow)? Clearly, mail is not intended as something to be immediately put in the vaults, on the shelf, in the bins or into a computer data bank. The value of the mail service lies in expeditious delivery of the mail.

Finally, once again we must ask: To what degree is the mail service a transactional flow instrument - - 100%, 50%, 25%?

This process is then repeated for each of the remainder of the CRAE information resources until all of them have been positioned somewhere on the north-south and east-west axes of the information mapping grid.

In the CRAE case here are some of the questions and outcomes. First, CRAE asked itself: Are there any information resouces not shown on our map which the company should be taking advantage of? Or has something important the company actually uses been overlooked by the preliminary inventory? Second, the strategic information assets for the company appeared to be confined to a cluster in the lower right quadrant, i.e. in a polygon formed by Geochemical Data, Drill-log and Assay Data, Maps and Charts, and Exploration Reports. Each member of this cluster tended to have one or more systems located in the central part of the map with which it is functionally closely allied. Third, according to its location of the map, the Library Service resource was evidently valued only for its holdings, not for services it provides. Fourth, the company's computer systems were viewed essentially as functional tools, evidently not closely allied with databases, analytical systems or other applications. Fifth, can or should some of the constellations of closely juxtaposed resources be managed as a group by a single manager? Sixth, can comparisons be made between and among the information resources in the same constellation, much as we might compare the sales performance of a company's sales offices that are geographically dispersed? And seventh, can or should the company try to reposition individual resources if their responsiveness (as revealed by audits, evaluation studies and assessments, and so forth) is found deficient?

In summary, the construction of a corporate information map of CRAE's information resources allowed it to see all of them at once, together on a single page. The map revealed natural relationships by clustering like resource entities. The map also provided CRAE's information managers with an analytical tool relating all resources to a common framework, much as the explorer's reconnaissance map relates mountains, rivers and lakes to a geographic grid, revelaing critical relationships that can lead to discovery.

The United States Department of State

The U.S. Department of State is the principal foreign policy and foreign affairs organization of the United States Government. The Department has some 24,000 employees scattered at nearly three hundred embassies, consulates, special missions, and other kinds of posts around the world. Tens of thousands of messages are sent from the Secretary of State and his staff headquartered in Washington, D.C., to American ambassadors and other elements of the U.S. country team in foreign countries every day, as well as received from abroad.

In 1977 this author began a two year study to inventory a representative sample of information resources. Whereas the CRAE questionnaire developed for that company's inventory involved about 20 data elements, the State Department's form prepared for the same purpose was considerably more sophisticated and included over 80 data elements.

Questionaires were send to about 100 different headquarters bureaus and staff offices and posts overseas. Because the Department's organization was so large, unlike the more personal approach used by Burk with CRAE (he filled out the forms as he interviewed the various offices and managers), it was necessary to prepare detailed instructions, and visit some posts and most Washington, D.C. offices to ensure that all of the information was obtained and the form was filled out correctly. The entire process, from the beginning of planning and the initial preparations, through interviews and mail questionnaire processing, through data base construction, and the generation of the final "maps" took over a year. This contrasts with the two months taken by Burk.

The total number of resources surveyed in the State Department inventory was nearly 600. Eliminating duplicates (where the same information resource was used in more than one office or location, the final count was closer to 300 discrete information resources (this compares with CRAE's 74).

Unlike CRAE, the Department of State decided to automate the data using a DBMS software package, with a view to keeping the material up-to-date in the future with additions, deletions, and changes. The PARADOX software product was chosen, and the data base was programmed so as to generate seven key indexes. Unlike CRAE, a matrix type mapping grid was not used, but may be in the future.

The seven key indexes were prepared with an eye to producing a hard copy printed directory for "desktop" use in the Department and overseas, much like a telephone book or an organizational directly. In conventional library style, one index was the "main section," and contained an abstract summary (about 15 of the 80+ data elements), taking about a half page. Another index arrayed the 300 discrete information resources by the parent organizational element responsible for providing it to the Department as a whole (this index was in organizational hierarchical sequence). A third index arrayed the resource entities by location, so that, for example, if a foreign service officer was about to be posted to Bonn, he could look up all the information resources that he could expect to find in Bonn. A fourth index arrayed the resources by subject; a fifth by program supported; a sixth by hardware and software; and a seventh by the Department's special indexing categories ("Tags and terms" as they are called).

As of this writing, these indexes, in draft, are being cleared by the Department's top officials to ensure they are accurate, complete, correct, and do not inadvertently disclose sensitive or classified information (CRAE, too, was sensitive, understandably, to certain key mineral data holdings).

At some future data, the inventory resources online data base may be more widely opened up to the Department, although this decision has not as yet been reached.

REFERENCES

1. C. F. Burk and F. W. Horton, InfoMap: The Complete Guide to Discovering Corporation Information Resources. Prentice-Hall, 1988.

2. John F. McLaughlin with Anne E. Birinyi, "Mapping the Information Business," in Understanding New Media: Trends and Issues in Electronic Distribution of Information, ed. Benjamin M. Compaine (Cambridge, Mass.:Ballinger Publishing Company, 1984), pp. 19-67.

3. Cornelius F. Burk, Jr., "Auditing the Management of Information Resources: A Challenge for the '80's," (Ottawa, Ontario: Office of the Auditor General of Canada, October 1984), Discussion Paper 39, Figure 1.

TRANSDOC – ELECTRONIC DELIVERY PROGRAMME

by

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TRANSDOC is an experimental programme for the electronic archiving and distribution of documents which has been developed by a group of 6 French organizations, from 1983 to 1985.

It is one of the 10 projects in the DOCDEL general programme (document delivery) of the EEC (European Economic Community).

The TRANSDOC programme made it possible :

- to test the various techniques that have recently been invented and that make it possible to implement electronic documentation, digitalization of images, archiving on digital optical disks, etc...,

- to determine the impact of these technologies on the entire data processing chain from the creation of data bases to the readout of the entire text, including its storage.

On the initiative of the French Council for Scientific Research (Centre National de la Recherche Scientifique, or CNRS), several partners have joined together and formed a scientific group to develop this programme :

. the Scientific and Technical Documentation Centre (Centre de Documentation Scientifique et Technique, or CDST), a part of the CNRS,

. the National Institute of Industrial Property (Institut National de la Propriété Industrielle, or INPI),

. the Study and Research Department of the French Electric Company (la Direction des Etudes et Recherches d'Electricité de France, or DER/EDF),

. the Department of New Studies and Techniques of the French Gas Company (la Direction des Etudes et Techniques Nouvelles du Gaz de France, or DETN/GDF),

the National Federation of the Specialized Press (la Fédération Nationale de la Presse Spécialisée, or FNPS),

the Telesystemes Company.

As part of the extensions scheduled for 1986, the Head of Libraries, Museums, and Scientific and Technical Information (Direction des Bibliothèques, des Musées, et de l'Information Scientifique et Technique, or DBMIST) of the Education Ministry will join the TRANSDOC group.

Several factors have favored cooperation on such a test, especially the high cost of needed investments.

Moreover, this programme has benefited of financial support from the EEC and French public authorities, i.e, the Interministerial Mission for Scientific and Technical Information (Mission Interministérielle de l'Information Scientifique et Technique, or MIDIST).

General description

The TRANSDOC programme consisted of designing, developing and finalising a system that would integrate all the functions of a general information system as follows:

- *The acquisition and storage* of the entire text of the chosen store of documents in accordance with facsimile image processing techniques. In the case of TRANSDOC, the technique consisted of using a scanner to transform the document, either in microfiche form or on the original paper, into a black and white numerical image with a definition of 8 × 8 points per millimetre in accordance with the CCITT Group III standard
- *The coupled use* of the archiving system with several internationally distributed databases by means of a host (Télésystèmes-Questel) that allows access to the document
- *The electronic readout* of documents previously stored on digital optical disks or microfiches by means of a high-definition screen or laser printer, locally in an initial stage.

TRANSDOC has tested two types of technical equipment for the electronic storage of documents as follows:

1 *Digital Optical Disk (DOD) equipment* developed by the French MC2 Company and made of American equipment from the Integrated Automation Company and French equipment (especially the digital optical disk from Alcatel Thomson Gigadisc (ATG)). In this type of equipment, the digitised images obtained after transformation of the paper document by numerisation are stored on DOD in a compressed digital form.

2 *Microfiche equipment* developed by Compagnie Générale d'Automatisme (CGA), including a cabinet that can contain up to 5000 A6-standard microfiches, with automated access and digitising of the microfiched document on request.

In both cases, link and access to the document is handled by a Mini 6/Bull computer, which performs the link between the logical reference (documentary reference) and the physical reference (storage address) of the document. This management computer may receive the documentary references in the following two ways:

1 Through an intermediary local or remote (Questar Bull) interactive acquisition station.

2 At a distance, by means of a database host which contains, among other things, the bibliographical references of the documents.

Moreover, the system keeps a trace of all transactions for purposes of accounting (follow-up and customer billing), statistics and processing connected with copyright.

Though it has integrated all the functions for the specific needs of the test, this architecture makes use of

the modularity and complementary nature of the systems. In particular, TRANSDOC becomes a complementary system for bibliographical database hosts and remains a system open upstream that can be connected to other host systems (this was done during testing for the EURODOCDEL project) and also open downstream for remote delivery of stored information.

In all cases, a basic principle of modularity has led to the specialisation of two interconnected processors, one of which handles management functions (Mini 6/Bull) and the other of which handles image-processing functions (ILC or image link controller). The general architecture of the system is illustrated in Figure 1.

The test

The test was based on the following:

1 *A scientific and technical store of documents:*
- A selection of scientific periodicals in the biomedical field for which the FNPS (a partner of TRANSDOC) obtained a specific authorisation from the publishers concerned
- French patents published in 1985
- Internal technical reports from Electricité de France and Gaz de France.

2 *Databases:* produced by the partners, Centre de Documentation Scientifique et Technique du CNRS (Centre National de la Récherche Scientifique), Institut National de la Propriété Industrielle, Electricité de France, and Gaz de France, and widely distributed:
- Pascal for the field of scientific periodicals
- INPI 1 for patents
- EDF-DOC and DAUGAZ for technical reports.

3 *The international host Télésystèmes-Questel.*

4 *A group of publishers:* (the FNPS) for the study and observance of copyright (a very sensitive field; one in which legal texts should be overhauled).

5 *European users:* such as researchers or research laboratories, industrialists, academics (the Faculty of Medicine of the Catholic University of Louvain, the Faculty of Lausanne) and so on.

By traditional means of access to hosts and bibliographical research through databases, users confirm their choice and, in transparent and automatic fashion, obtain access to the entire text stored in TRANSDOC. Initially, the text is sent by mail after being printed by laser printer locally. Later, this will be done remotely by telecopy or transmission by satellite.

The test has made the following possible:

1 To acquire know-how in the field of archiving and electronic document delivery. This has enabled each participating organisation to decide to use and promote these technologies in its specific fields in order to modernise its services or create new services. TRANSDOC has made a significant contribution — though this was neither the initial purpose nor the main motivation of the partners — to the improvement or stabilisation of industrial products, some of which are now being marketed.

2 To inform the public and enhance its awareness to a considerable degree through publications, reports, conferences, colloquia and visits (over 1000 visitors came to TRANSDOC in one year) with regard to the possibilities opened up by these types of technology.

3 To understand the legal problems involved in copyright. Solutions will soon be proposed that will no doubt lead to more appropriate legislation.

4 To design production lines and estimate costs and, thus, the cost price of a stored or delivered page.

5 To evaluate, with the help of experts appointed by the EEC, all tests on the technical, economic and user-service levels. The results of these studies will be recorded in reports submitted to the EEC. In a general way, they deal with the time and quality of processing, associated costs and the level of satisfaction of users.

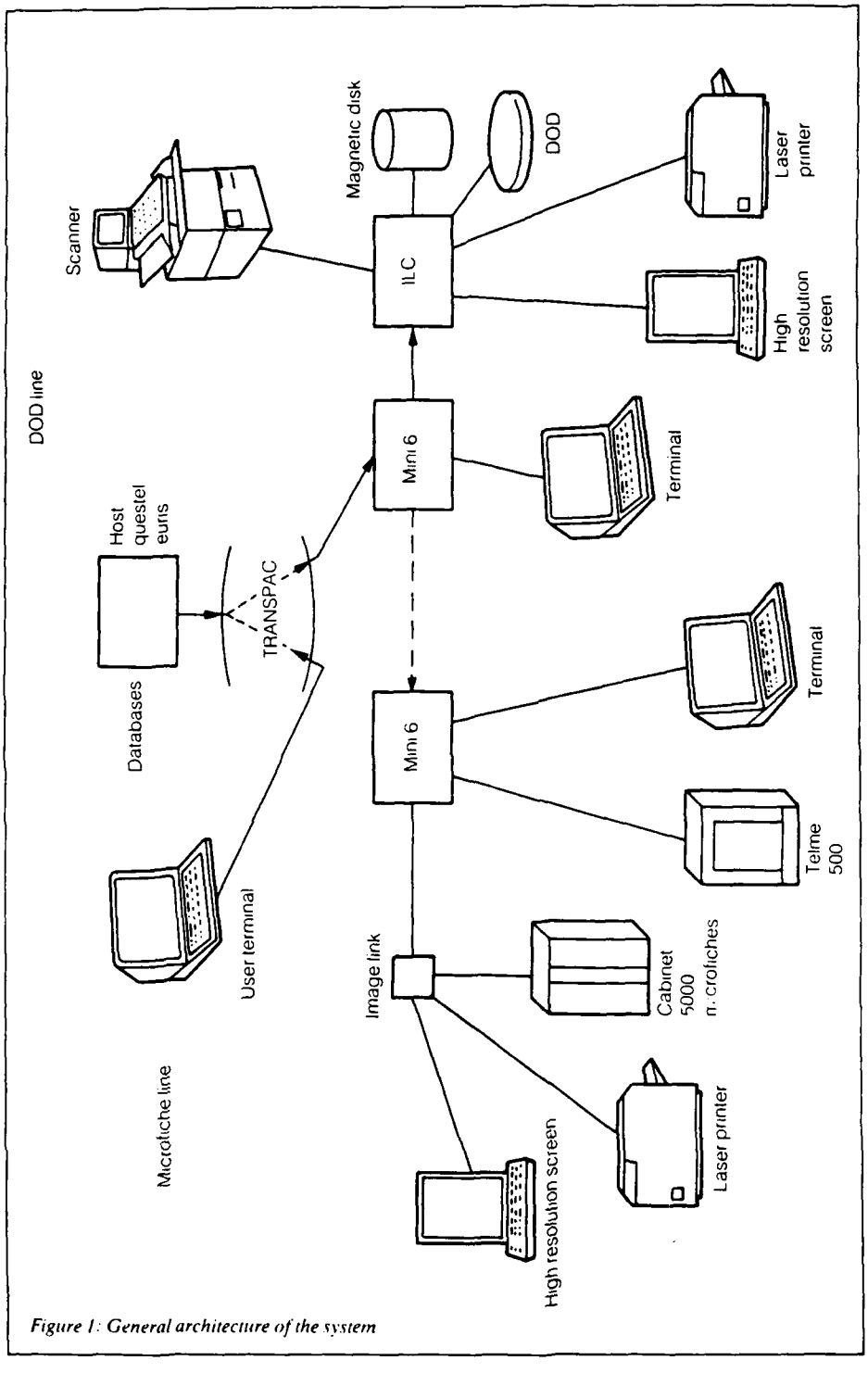

Figure 1: General architecture of the system

Future developments

The expert knowledge of archiving and the know-how acquired during the programme will enable each of the partners to develop, on the basis of TRANSDOC, models of future services alongside studies and developments now underway in the field of electronic archiving, as follows:

- For INPI, the creation of a centre of documentary study and research to take over the stock of French patents in digitised form (7 000 000 pages)
- For EDF, the creation of a centre for archiving (on DOD) the internal memos of the study and research division
- For Télésystèmes, a plan to create a scanning centre for the archiving of documents from outside clients and a plan to store them on CD-ROM
- For the CNRS, integration of new technologies within the framework of creation of the new centre for the intensive document delivery in Lorraine.

The objective will thus be to test services based on an archiving system involving the following:

- Technologies already tested in 1983-1985
- New telecommunication technologies allowing delivery at a distance
- More appropriate organisations for these services with a view, in particular, to reducing the time periods required to make the information available.

The proposed extensions will consist of delivering documents electronically to customers, either by Group III telecopy on a public packet-switching network or by a high-flow transmission network, using the services of TELECOM 1 TRANSDYN or TRANSCOM with 64 Kbit/sec (see Figure 2).

Transmission by Group III telecopy

This will be developed on two lines of equipment and will enable a user equipped with a Group III telecopier to receive a document that he considers urgent at very short notice (half a day at the most).

Three types of service are proposed as follows:

1 A service providing access to scientific articles on digital optical disks in connection with the CNRS' Pascal database.

2 A service providing access to EDF and GDF technical notes on digital optical disks in connection with the EDF-DOC and DAUGAZ databases.

3 A service providing access to INPI and computer representational trademarks placed on microfiches and stored in the microfiche equipment in connection with INPI's trademarks database.

In view of the low rates of flow that are possible in telecopy on a packet-switching network, the large amount of information to be sent on it, the number of installed telephone lines (two in the initial stage, which could be increased to four later), and the substantial cost of teletransmission to be paid by the user, the service will be limited to about 600 pages per day — that is, an average of 80 scientific articles. On the other hand, the representational mark service, estimated commercially at 100 pages per day, will be unlimited. In both cases, transmission by telecopy is done automatically by the system and makes it possible to provide continuous day-and-night service.

Despite the technical limitations linked to the low rates of transmission flow and the higher costs with respect to the traditional service, it has become clear that this type of service is of interest to certain users who have an urgent need for the document.

High flow transmission (by satellite)

The problems mentioned above are solved to a large extent by transmission at 64 Kbit/sec. However, in view of the subscription fees and the utilisation costs of the TRANSDYN and TRANSCOM services and the costs of acquiring transmitting or receiving communication computers, this solution cannot be selected or justified except for the sending of large or numerous documents. This situation has led to the proposal of an inter-library 'electronic supply' service.

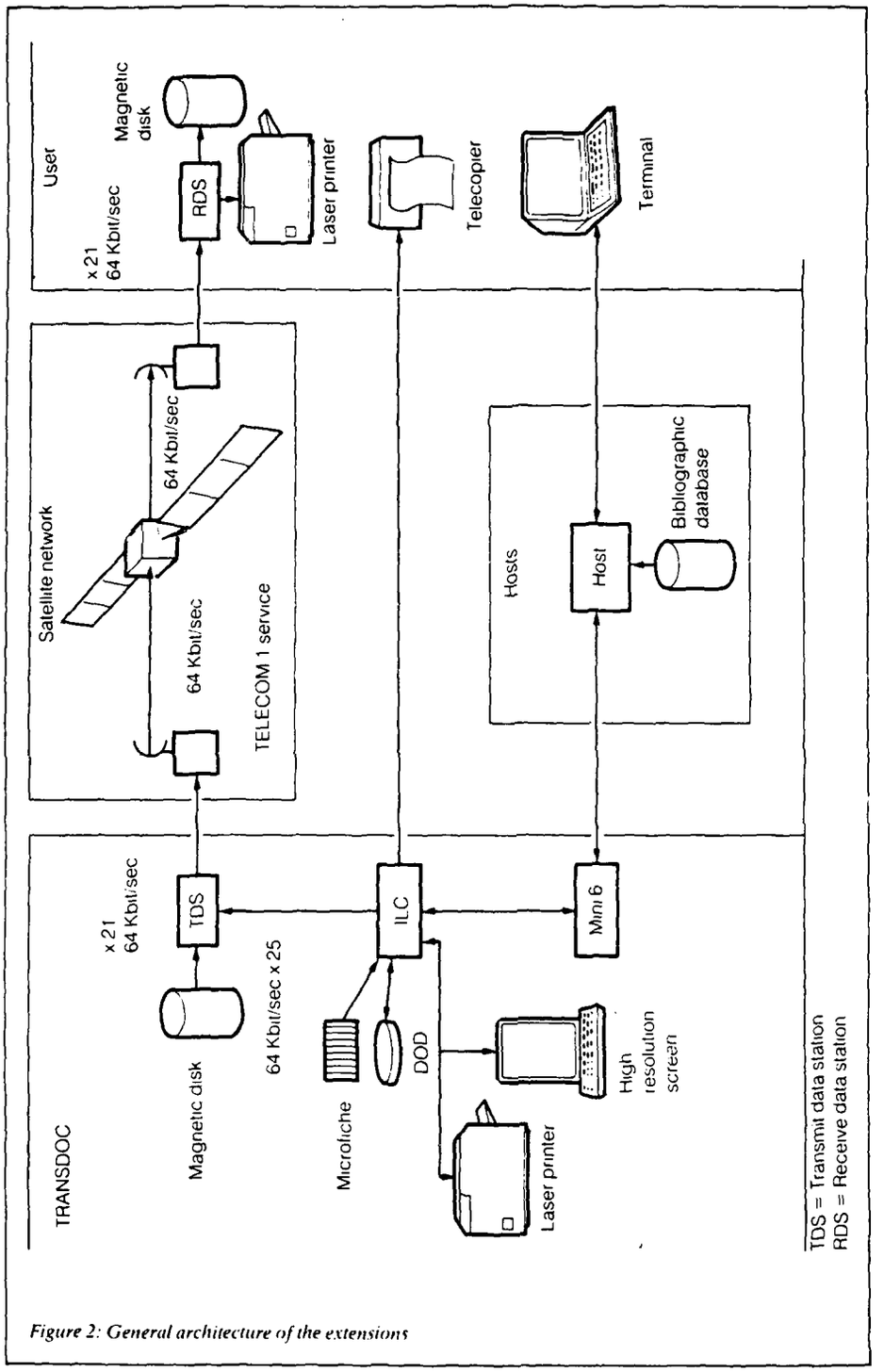

Figure 2: General architecture of the extensions

On the basis of TRANSDOC serving as an archiving centre, to which will be connected a transmit data station controller linked to TELECOM 1 services and a French university library (another documentation centre in Europe is under study) equipped with a receive data station controller, also linked to TELECOM 1, it will be possible to transmit scientific documents stored on digital optical disks, for which a request has been made directly, either by the library or via the Pascal database.

For this experimental service the subscription fees for TELECOM 1 services are paid by the TRANSDOC group, and the cost of querying the Pascal database, supplying the document transmitted and of utilising the system, is paid by the library.

Conclusion

The TRANSDOC test has yielded positive results and has made it possible to confirm the following:

- It is technically possible to perform archiving electronically and the organisations needed to implement these new technologies do work
- There is a good match between the services tested and the needs of users; new services can be created and current ones improved.

Beyond purely technical tests, the significance of such testing which is oriented towards routine use and the evaluation of the needs of future customers is, by now, completely obvious. TRANSDOC has made it possible to confirm that the arrival of these new technologies will considerably modify the information market in all its forms very quickly.

DECENTRALIZATION OF DATABASES AND THE COMMUNICATION BETWEEN THEM

by

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SUMMARY

Database management sysems (DBMS) have for many years been used to develop centralized information systems, where the database and the application programs are stored at a central computer. DBMS have also resulted in decentralized information systems in which data and programs are stored at several sites with none or very little communication between the sites. With the advent of distributed database management systems (DDBMS) new possibilities for developing information systems have emerged. An "ideal" DDBMS supports an information system database stored at several sites in a computer network in such a way that users can access data at any site in the network as if they were stored at the local site. In this paper we look at some of the necessary properties of an "ideal" DDBMS including location, replication and fragmentation transparencies.

The advantages of DDBMS compared with CDBMS such as local control of data, better system availability etc., are discussed together with some of the disadvantages of DDBMS such as updating of replicated data and a generally more complex environment than in a central DBMS-system.

The advantages of a distributed information system compared to a decentralized information system are also discussed.

Another area creating new opportunities for interconnection between information systems is the development of application level protocols within the ISO Open Systems Interconnection Model (OSI). How this compares to DDBMS-based solutions will be discussed.

Finally an example of how we have chosen to approach the new technologies in BIBSYS a Norwegian library system will be given.

1. BACKGROUND

Database management systems (DBMS) have for many years been used to develop centralized information systems, where the database and the application programs are stored at a central computer. DBMS have also been used for decentralized information systems in which data and programs are stored at several sites with none or very little communication between the sites, and where the different sites operate more or less independent of each other. With the advent of distributed database management systems (DDBMS) new possibilities for developing information systems have emerged.

2. WHAT IS A DDBMS?

P.J.Pratt (1) defines a distributed database as "a database that is stored on computers at several sites of a computer network and in which users can access data at any site in the network", and "A DDBMS is a DBMS capable of supporting and manipulating distributed databases". The distributed database supported by the DDBMS can be considered the union of the databases at the different sites. The definition of the distributed database is called the global schema.

C.J.Date (2) states the "fundamental principle of distributed database": "To the user, a distributed system should look exactly like a nondistributed system". User is here understood to be either an end-user or an application programmer performing data manipulation operations. According to the fundamental principle the distribution aspect of the database should be transparent to the user. This leads to a number of desirable transparencies some of which are:

Location transparency

This implies that the user may access data at a remote site easily as he accesses data at the local site. For the user the entire database seems local, possibly with greater response times for remote data.

Concurrency transparency

This implies that many users may access the distributed database at the same time as if each user has exclusive access to the database. The system prevents the updates of one user to interfere with the updates or retrievals of another user.

Replication transparency

It may be desirable to duplicate (replicate) some of the data in the database at more than one location. Replication transparency implies that the user may only see this indirectly for instance through a possibly better performance or a higher availability.

Fragmentation transparency

This makes it possible to split a file (table, relation) of, for instance, customers in fragments such that the fragments at each site contain the customers at that site. This may lead to better performance or availability if the data is most often used at the local site.

Performance transparency

This means that the DBMS-system will optimize processing of queries such that the user does not have to consider performance questions when he makes his query.

3. COMPARING CENTRALIZED AND DISTRIBUTED DATABASES

One may wonder why one should use a distributed database if its main property is that it shall look like a central database to the user! However this does not change the fundamental fact that the data and programs are stored at several interconnected sites in a distributed database and this implies some basic differences between a central and a distributed database. Some of the advantages of DDBMS are:

Local control of data

The distribution of the data may be made to fit naturally into the organisation and make local data autonomy possible. With the movement towards decentralized decision-making in large organisations this may be one of the major reasons for using DDBMS.

Increasing capacity

Instead of expanding a central site it is possible to expand the local site where the capacity is needed.

Higher availability

If a central database becomes unavailable, no users can continue processing. If a site in a distributed system becomes unavailable only users needing the data stored at that particular site need to be affected. If the data of the unavailable site is replicated at the available sites even higher availability may be obtained.

To continue processing when a site becomes unavailable is however not without problems. If for instance part of the network between the sites is down, resulting in a partition of the network into two isolated subnetworks and the users continue to update the disconnected database, inconsistencies in the database may occur. According to S.B.Davidson (3): "The design of a replicated data management algorithm tolerating partition failures is a notoriously hard problem".

Better security

The system is more vulnerable if all the data is at a single site.

Shorter response times for local data

Lower communication costs

If only local data is processed in a high proportion of the queries this may lead to lower communication costs.

New communication possibilities

If the local computer site is connected to a local area network this may make new communication solutions possible, for instance transmission of high-resolution pictures from the local computer site to the user terminal. Communication costs or communication capabilities may prevent this in a central system.

4. ADVANTAGES OF DISTRIBUTED COMPARED TO DECENTRAL DATABASES

Reduced duplication of data

In a decentral system each site must have a complete database, which may result in extensive unintended duplication of data. In a distributed system no duplication is necessary, but we may duplicate data in order to get a better performance and a higher availability.

Reduced work with updating of data

In a decentral database each copy of the same data has to be updated separately. In a distributed database with replication transparency we only have to update the data once and the different copies (replicas) will be updated automatically. In some cases this may be a major benefit.

Transparent access to the whole updated database

In a decentral database access is restricted to the local site and costs usually prevents this from being the complete database. Copies of data from other sites will also usually be less updated than at the original site. In a distributed database with location transparency all data will be accessible at each site as if they were stored and updated at that particular site.

Better cooperation between sites

Decentral systems easily result in local sites with little cooperation and different development paths where each site promotes its own goals. In a distributed system a much closer cooperation is necessary both between the various computer-sites and between the users.

5. DISADVANTAGES OF DISTRIBUTED COMPARED TO CENTRAL AND DECENTRAL DATABASES

On line updating of replicated data

Replicated data can result in severe update problems when we on-line have to update more than one copy of the data. We have the overhead of updating copies at remote sites, and what do we do when for instance one of four copies of the data is unavailable for updating? In decentral systems we use less advanced solutions, such as double registration of the data and file-copy via tape.

More complex databases solutions

The distributed database management software is more complex than a single site database management package and DDBMS are yet not as developed and tested as the corresponding DBMS packages. It is also more difficult to design a distributed database than a central or decentral database and the database and the application software running at several sites is more difficult to maintain.

6. ISO/OPEN SYSTEMS INTERCONNECTION

The International Standardisation Organisation (ISO) have presented an Open System Interconnection model (OSI) for communication between sites. The model is divided into seven layers from the physical (1st) to the application (7th) layer. The communication rules for the different layers are specified in protocols. The ISO/OSI-model has gained widespread acceptance and at present work is being done also on the standardisation of application protocols. The lower layer protocols may be common to many applications, but at the application level more specific protocols are necessary. An interesting thought is to use OSI communication protocols between the sites of a distributed database. New special protocols will have to be developed for this purpose, but first we need a standard model for a distributed database. According to a note in Computerworld Norge (4), ISO/OSI is planning to develop a standard model for distributed databases within the next 4 years.

7. USING OSI APPLICATION LEVEL PROTOCOLS

The work taking place on application level protocols will open new possibilities for communication between information systems. For each new protocol being specified and implemented a new possibility for communication between systems has been created.

In the library area application protocols being worked upon are for instance:

Interlibrary loan

This will make it possible on-line from my local library systems to send loan requests to any other library system which has implemented the protocol, and where I have an interlibrary loan agreement.

Search and record transfer

This will make it possible from my local library system to do on-line search in another library system with my local system dialog and to transfer found data from the other system to my local system.

Acquisitions

This will make it possible from my local system on-line to buy books from any bookseller which has implemented the protocol. At present you have to use a special software package on the PC for each bookseller you are interested in buying from or you have to use ordinary mail.

Work is also proceeding on other protocols of interest in information systems, for instance electronic mail and virtual terminal.

The main benefit of using OSI applications layer protocols as I see it is that from your local system you may reach any other information system where the protocol is implemented and use your local system dialog for interaction with the remote system. Of course you may have to make some form of agreement with the other site in advance, for instance some sort of access permission from the other site.

8. COMPARING DISTRIBUTED DATABASES AND APPLICATION PROTOCOLS

Distributed databases is an advanced way to connect information systems. Seen from the local user all relevant data is in one big database available through his local system. We can also use OSI application protocols to connect information systems. The user in this case is seeing the data as a collection of databases which he may reach from his local system.

Advantages of using distributed databases:

The distribution of the database is transparent to the user. This implies for instance the transparencies mentioned earlier and their advantages.

Advantages of using application protocols:

Technically simpler

It is a technically looser connection using application protocols between databases than linking the databases in a distributed database and a also more easy system to implement and manage.

Greater local autonomy

If you, for instance, participate in a distributed database system and some of your local data are replicated at another site, every update of the replicated data done at the other site is automatically also performed on your local database. This may indeed be what you want, but you have lost the local control of the updates of your local database. A much closer cooperation both technically and administratively is necessary between sites in a distributed database than between sites linked via application protocols.

Wider reach

More sites can be reached via application protocols than what is practical to integrate in a distributed database.

More standards

The work on standards for application protocols has come further than on distributed database standards (I would guess a 5 years lead). It should be noted that much work still remains to be done also on the lower levels OSI protocols. This includes both standardisation and not least implementation work.

9. BIBSYS APPROACH TO A DISTRIBUTED SYSTEM

BIBSYS is an integrated library system primarily for the universities and other higher educational institutions. BIBSYS is now going through a major revision using new software and hardware (Adabas DBMS and NATURAL 4.gen language on IBM-equipment). It has been decided that we first shall develop a central system with a main bibliographic database and afterwards make a distributed system. The distributed system shall have the main bibliographic database at a central site and with local copies of the data corresponding to the collection at that site. In designing the database for the central system we have tried to anticipate the requirements of the distributed system. An important step has been to identify how the different files should be distributed and if it was necessary with on-line update of every copy of a file. Indeed it seems that only a few fields actually need on-line update both locally and centrally; we plan to take advantage of this to simplify the problems connected to on-line updating of replicated files in the distributed system.

In order to communicate between BIBSYS and other library systems we participate in the BIBNETT 3 project, where we plan to implement the ISO application protocol for searching, retrieving and updating another database. The main purpose

is to be able to search and copy records from a national bibliographic utility from a BIBSYS-application program. Eventually this may also be used to communicate with other systems which implement the ISO protocol.

10. CONCLUSION

Central, distributed and decentral database systems will all be used in the future; they are all valid solutions for some systems. With the research and development going on in the distributed database management area DDMBS will undoubtedly be used for developing more advanced systems than anything seen today. However bright the future may look for DDBMS they are still technically complex with a limited applicability. As I see it, the OSI level 7 application protocols has a much wider usage potential especially in information systems linkage. "No information system is an isolated island, the bridge is an OSI level 7 application protocol!"

REFERENCES:

1. Pratt, P.J. and Adamski, J.J. DATABASE SYSTEMS: Management and Design. 1.ed. Boston 1987, p.609.

2. Date, C.J. WHAT IS A DISTRIBUTED DATABASE SYSTEM? (Part 1). The relational journal. Issue 1. June 1987, p.25.

3. Davidson, S.B., Garcia-Molina H. and Skeen, D. Consistency in Partitioned Networks. Computing Surveys. Vol.17, No.3, September 1985, p.342.

4. Betts, M. (Computerworld USA). OSIs annen aera. Computerworld Norge, Nr.11 1988, p.13.

FOSTERING INTERACTION

of

GOVERNMENT, DEFENSE, and AEROSPACE DATABASES

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SUMMARY

The Department of Defense (DoD) knowledge worker needs rapid access to select information contained in government, defense and aerospace databases. In the United States, information of use to defense and aerospace specialists are contained in multiple government databases as well as in commercial databases. This paper addresses policy and technology strategies which are being developed by the Defense Technical Information Center (DTIC) to foster better interaction among government, defense and aerospace databases. To improve interaction, considerable progress has been made by the evolving standards in communication protocols, operating systems of computers, database management systems, and command structures, but it is the Defense Gateway technology that permits interconnectivity and interoperability in the interim period. This makes it possible to make the growing number of heterogeneous databases available to the defense community in a progressively more unified and automated manner. We describe the results of several projects that introduce a high degree of information robotics to Information Resource Management (IRM) with substantial increases in human productivity.

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INTRODUCTION

In the United States (U.S.), the Department of Commerce, Department of Energy (DOE), National Aeronautics and Space Administration (NASA) and the Department of Defense (DoD) all have scientific and technical information (STI) collection and dissemination facilities. Each of these facilities collects information which falls into the aerospace and defense subject areas. The Directors of these organizations recognized that it was in the best interest of their respective user communities to have an open dialogue with each other and to seize opportunities for developing a common approach to problem solving and offering new services. They formalized their interaction by forming a group known as CENDI which stands for Commerce, Energy, NASA and Defense Information. The CENDI representatives are the Directors of the National Technical Information Service (NTIS), the DOE Office of Scientific and Technical Information (OSTI), the NASA Scientific and Technical Information Branch and the Defense Technical Information Center (DTIC). The National Library of Medicine has also joined CENDI.[1]

The CENDI group meets every six weeks. Their agenda topics cover policy, technological, personnel and financial resource issues. CENDI seeks to develop unified methodologies for making information available to their user communities. This helps the user communities in two important ways. First, because the organizations are working together, they can frequently pool resources resulting in a lower cost to each of the involved organizations. This means that the organizations are able to do more for their users because they are pooling resources. Secondly, often individuals are users of more than one of the organizations and benefit from interagency standardized procedures.

The Defense Technical Information Center (DTIC), under auspices of the Defense Logistics Agency (DLA), is responding to this challenge by developing and implementing innovative IRM tools that foster better interaction between DoD requirements for up-to-date information and resources available in industry. Specifically, the DTIC is accelerating the effective utilization of scientific, technological, textual and numeric databases. To broaden the scope of this endeavor, gateway techniques are being established to automate the access and utilization of information resources worldwide. The focus is on the defense community in coordination with member countries of the North Atlantic Treaty Organization (NATO) in a planned Scientific and Technological Information Network (STINET).[2]

The DTIC work at the Defense Applied Information Technology Center (DAITC) includes the prototyping and demonstration of new technologies. This report reviews problem areas, possible solutions, accomplishments and plans to unlock the wealth of scientific and technological databases and models worldwide. Substantial improvements in interconnectivity and interoperability have already been demonstrated among dissimilar computers and communication networks. It has enhanced the acquisition, utilization, and management of data by electronic means and has led to innovative products capable of extracting new insight and forecasting from the immense data stores. The DTIC projects thus contribute to a more cost-effective work environment for the knowledge worker in the defense community, save time, costs, stimulate creativity, and lead to more enlightened decision-making.[3] This section of the paper focuses on the Defense Gateway technology which is being utilized to increase interaction and interoperability among government, Defense and Aerospace databases.

THE DEFENSE GATEWAY TECHNOLOGY

1.0 Interoperability and standardization

Interoperability depends on our ability to physically **interconnect and use as one** the burgeoning number of hardware and software components that excel and compete in their field of specialty. Being able to interconnect the best is a goal driven by user demand and shrinking budgets. Unlike in the automobile transportation industry, standardization is coming about because information derives from language and mathematics, the two well defined means of human communications.

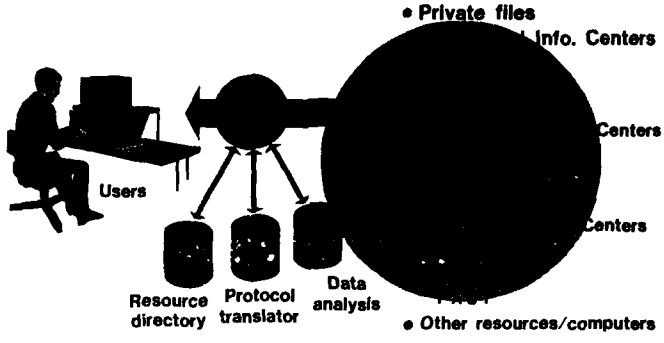
Industry and the Federal Government are making progress in standardization and interconnectivity among dissimilar IRM components. Industry is recognizing the advantages of compatibility in a buyers' market which demands products to be plug-compatible, regardless of their make. Efforts by the Corporation for Open Systems (COS), the NBS Computer Institute for Science and Technology (CIST), the annual Interoperability Conferences, the DoD Computer-aided Logistics Acquisition Support (CALS) initiative, and the various ANSI and ISO/CCITT committees are all working on the definition of practical computer-related standards for [4]:

- Operating Systems - POSIX
- Communications - GOSIP (V-1, FIPS-146), ISO/CCITT X.500 and 802.3
- Database Systems - SQL
- Bibliographic Commands - CCL
- Engineering data (CALS) - MIL-STD-1840A

etc.

Standards always lag behind invention and are still ill defined for the highly competitive fields of electronic word processing, numeric data manipulation and the graphics user interface. In the continuously changing work environment, we need generic software that can provide the framework for integration of computational tools. Requests for Proposal (RFPs) issued by the defense community now require compliance with known and anticipated standards. The time period of incompatibility has to be bridged, therefore, where possible, through translation. This perpetual evolution can be utilized without disruption of service with gateways, strategically located in information networks.

Gateways, front ends, intermediaries, or interfaces have been reviewed in their historic perspective by Martha Williams.[5] All have the role of translation and transaction control at an electronic information boundary. The Intelligent Gateway concept, however, is different from simple communication gateways that are installed as interfaces between networks, or that serve as entry points to networks: The Intelligent Gateway concept provides a controlled resource environment for an organization's internal behavior and is its electronic interface to the outside. Gateways represent a generic capability for the flexible and extendible utilization of geographically distributed, heterogeneous information resources in a unified manner. Gateways are integrators, yet offer freedom of adaptation to change, innovation, standardization, and accounting in one intermediary system. **Gateways thus represent a bridge to the future.**



This powerful technology has the advantage of controlling not only access to corporate resources and monitoring of their use, but permits also the optimization of resources. Moreover, by inclusion of object-oriented table-driven programming techniques on the gateways, it is possible to retain the functionality of proven, albeit dated, application programs by encapsulating them for execution on the gateway system as menu-driven options. The major components of the gateway concept are: **(1) Global directories, (2) Translation tables, and (3) Tools for data analysis.**

Under development at the **Lawrence Livermore National Laboratory (LLNL)** since 1975, the Gateway technology has received wide acceptance in the Federal Government, especially the military departments. The IGP software is used at over 50 installations in the United States and in NATO countries where it saves time and costs in the procurement of equipment, the identification and distribution of spare parts, the allocation of provisions, the scheduling of optimal transportation carriers, and the utilization of bibliographic and numeric databases in science and technology.[6]

One of the advanced gateway developments has been sponsored since 1983 by the DLA Defense Technical Information Center (DTIC) at the DAITC. It is the core technology of the **DAITC Interoperability Laboratory,** which is being built up as a micro-cosmos of the work environment in some defense communities, equipped with representative pieces of dissimilar hardware, software, and peripheral equipment. The initial work by DTIC has focused on directories to bibliographic databases, the design of generic translation programs for dissimilar commands and formats, and the prototyping of tools for the analysis of data sets. Known as the **Defense Gateway Information System (DGIS),** it serves as a prototype for the planned DTIC **Scientific and Technical Information Network (STINET)** [7].

Global annotated directories are the prerequisite to interoperability.

Today, nearly 4,000 databases are accessible online. Directories may point to their availability, but innovative search techniques are required to review their content, extract the desired information, and translate their dissimilar output patterns into common forms for analysis and decisionmaking. The growth of online databases identified by the Cuadra Associates Directory continues unabated:

Directory Issue	Number of Databases	Number of Database Producers	Number of Online Services	Number of Gateways
1979/80	400	221	59	
1980/81	600	340	93	
1981/82	965	512	170	
1982/83	1350	718	213	
1983/84	1878	927	272	
1984/85	2453	1189	362	
1986	2901	1379	454	35
1987	3369	1568	528	44
1988 (July)	**3893**	**1723**	**576**	**71**

Of these databases, those of interest to the defense community can be accessed and searched, as if they were one, by the DGIS **SearchMAESTRO** program. SearchMAESTRO can be directed to automatically conduct queries over several databases using user-specified keywords. A hotline service provides assistance to DGIS users on their terminals regarding search formulation, database selection, or any other problem that may arise during a session.[8]

In addition to these commercially available resources, the Defense Technical Information Center (DTIC) established an online **directory to over 400 DoD-sponsored R&D databases.** The hardcopy version of this directory has quickly become the 15th most asked-for DTIC publication. It complements earlier **DTIC directories of researchers** and **Industrial Application Centers (IACs).**[9]

Global directories to information resources are the starting point. Today, experts must still help with retrospective searches over several databases to negotiate the differences of indexing terms because federal departments, agencies, and industries use their own preferred indexing terminology for databases in their discipline. Cross-correlations of subject terms (keywords) among databases indexed with different thesauri must still be established. However, for the **NATO standardization program,** the DoD/DTIC thesaurus **DRIT (Defense Retrieval and Indexing Terminology)** has been selected by NATO members and should greatly simplify the utilization of defense-oriented publications originating from different member countries.[10]

Translation tables for the use of dissimilar resources

Translation is the key function of gateways. Even when standards exist, one cannot force or expect a distant computer or foreign information center to comply. But intelligent gateways, like interpreters, can be taught to "speak" the commands of the target computer and to "understand" their response. This translation capability of gateways must necessarily be extended to the input, output, and contents of transactions with different:

- o terminals
- o computers
- o peripheral equipment
- o communications
- o character sets
- o units of measurement
- o operating systems
- o database management systems
- o application programs
- o models
- o word processors
- o spreadsheets
- o presentation graphics
- o computer commands
- o data formats
- o input commands
- o output formats
- o programming languages
- o spoken languages

Some of the translation tables and rules for the needed information resources are well understood and operational. The Defense Gateway, for example, utilizes the terminal emulation table of the UNIX operating system that makes it possible for users to identify their terminals or PCs from a growing list of some 260 different workstations. Once identified, the gateway receives and sends the correct signals for proper execution of keyboard controls and screen displays. Similar virtual interfaces have been developed on the DGIS for the major brands of computers and communication networks.

An example for the latter is the commercial software now available that converts the text generated by 16 different proprietary word processing programs from one to another. Documents converted in this manner have the same external look because internal control characters are correctly translated inclusive of tabs, indents, bolding, underlines, columns, footnotes, headers, etc. Originally designed for use on stand-alone PCs, this type of software is being considered for adaptation to the Defense Gateway as a prototype for electronic word processor interoperability; i.e. reports generated by users in WordPerfect would automatically be translated into MultiMate when sent to those who prefer the latter.[11]

With regard to the translation of spoken languages, the extensive computer-aided translation services, like SYSTRAN and STS, can be accessed from terminals and PCs via gateways.[12] New products are appearing that will soon offer pairwise translation among the major S&T publication languages for personal computers. One of these, from Translation Services of Telecommunications Industries, Inc., has their software written in "C" which, installed on gateways, could serve a group of users. Comparisons with benchmarks are needed to judge their relative merit, and one may suspect that the articulation possible with mainframe systems will be difficult to match on smaller machines. On the other hand, translation software for PCs or departmental gateways allows protection of proprietary and classified translation in a controlled environment.[13]

To accomplish the feat of linguistic translations on PCs, a different approach is taken. Instead of complex rules and simple dictionaries, simple rules and complex dictionaries are used for each word and its synonyms. Users may expand and change word usage to adapt the translation to their discipline-specific preference or jargon. Some of the PC programs show the original text on the top screen and the translation below, allowing the user to modify the translated text, and/or the dictionaries, with an online editor. Translation software for programming languages could also be installed or made accessible via gateways with cost-effective licensing.

By installing and documenting different translation utilities on the gateway, users of PCs may continue the use of their preferred word processor (WP) programs and depend on the gateway for translation of their WP files to the preferred WP programs of others to whom they are addressed. During the gateway-induced translation process, users are alerted to new features, or their absence, in other WP programs. This gateway option retains the computer literacy of individual users while nudging them towards the preferred WP program of the organization. It permits also the installation of software for test and evaluation, and offers the opportunity to control authoritative corporate resources by downloading them from the gateway to PCs, and vice versa, as needed. By using a gateway in this capacity, changes and upgrades to newer software versions have to be made only on **one** system. Gateways thus do not impede the use of competing products; to the contrary, gateways accelerate their evolution and maturing.

The translation of command languages tackles one of the most difficult translation tasks and promises the greatest payoff when completed. The ongoing DTIC work is directed towards a generic **Common Command Language (CCL)** that could be applied to other translation tasks. The project started with the commitment to implement the **National Information Standards Organization (NISO)** proposed CCL standard. This standard evolves from the most often needed and the most popular features of existing bibliographic databases. In the early 1987, several quick DGIS CCL prototypes were successfully implemented in "C" using the standard UNIX tools of LEX and YACC for language translation. These prototypes established the feasibility of the project and provided insights into the problem. The second phase of the project now in progress utilizes Artificial Intelligence techniques of blackboard architecture and knowledge-based driven knowledge sources. **PROLOG** was chosen because it is a simple and powerful programming language based on the concept of programming in logic. The DTIC effort merges PROLOG and "C" capabilities to provide the DGIS user an AI-assisted interface. The goal is to establish a universal user interface for heterogeneous information systems. Presently, the CCL is being tested in its initial prototype for interaction with DIALOG, BRS, NASA/RECON, and DROLS. Future applications will involve subject switching among thesauri, hypermedia linkages, and numeric information query and processing.[14]

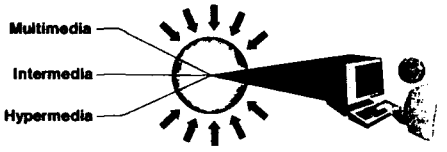
ARTIFICIAL INTELLIGENCE

DGIS Tomorrow * What's Possible ?

Common command language system
Diverse database query expert system
Thesaun integration for expert searching
Hypermedia implementation
Information processor systems
Routine generator expert system
Human foreign language interface
Numenc information query & processing system
Information analysis and ES application system
Portable natural language interface
Natural english language interface to UNIX

EXPERT DGIS

TECHNOLOGY CONVERGENCE



Tools for data analysis and decisionmaking.

The **DGIS Post-processor software** for bibliographic citations, **Process**, has been further improved with automated capabilities for access, translation, and analysis of the major federal and commercial textual information services available online. Downloading data from these systems is initiated by the user with simple gateway commands. Without these automated and powerful tools, it would be nearly impossible to extract new insight from the large volumes of dissimilar bibliographic services in the various scientific and technological disciplines. A robust, adaptive analysis tool for bibliographic citations from disparate sources was required and is now accomplished and provides powerful interoperability.[15]

Process supports two primary functions: the translation of tagged text and data into standard formats and the analysis of their information content. Although bibliographic data is the initial target today, this software can be used with any explicitly tagged data, e.g., the tagged neutral data exchange format of the CALS program. Reformatting for report generation or customized publication is included. Current translation capabilities include seven major federal and commercial online systems: DROLS, NASA/RECON, NLM, DIALOG, BRS, ORBIT, and NTIS.

The breadth of capabilities supported by the Process software is not available in any other system: The analytic software allows the user to conduct trend analyses and correlations. By explicitly tagging the various pieces of information within a citation, users may compile frequency distributions over time by subject, author, organization or by any other data tag or data content. In addition to frequency analyses, cross-correlations can be performed on the contents of any two data elements with statistics. Concordances can be printed in standard or user-defined formats.

Ongoing developments include intelligent filters to standardize the idiosyncratic formatting that occurs within and across databases, and the development of icon-driven display windows and graphics. The application of the Process techniques to full-text databases and to numeric databases is being explored. One application of the Process software is for automated referrals, or alarms, where the real-time analysis of the streams of 'hotline' news from the United Press (UP) and the Associated International Press (AIP) may lead to instant alerts, for example on accidents with hazardous materials.

Standards & interoperability for acceptance, storage, and distribution of CALS engineering data.

Incompatibility and lack of interoperability among technical manuals and engineering data for weapon systems is coming to an end. The **Computer-aided Acquisition and Logistics Support (CALS)** program requires vendors of future advanced weapon systems to deliver their technical manuals and engineering data in electronic digital form by 1992. This, for the first time, will give the DoD the ability to subsequently procure the upkeep of maintenance manuals and the manufacture of weapon systems independent of the original vendor. It also will allow for the effective utilization of the resultant information knowledge base by electronic means. The first order for compliance of industry with CALS standards for DoD weapons was ordered by Deputy Secretary of Defense William H. Taft IV this August and marks the beginning of the most important and far-reaching acquisition improvement. It also signals the beginning of direct interaction between databases in the Government, defense, and industry.[16]

CALS is a joint DoD and industry effort to enable productivity through the integration of technical information for weapon systems acquisition, design, manufacturing, and support. Primary CALS objectives include development of a unified DoD-Industry interface for technical information delivery or access in standard digital form, and definition of integration requirements for the contractor functional processes through which digital data is created and used. This is being achieved through the evolutionary series of functional requirements and technical standards that will be used throughout DoD in weapon system contracts, and in contracts for the DoD data system that processes and use technical information.

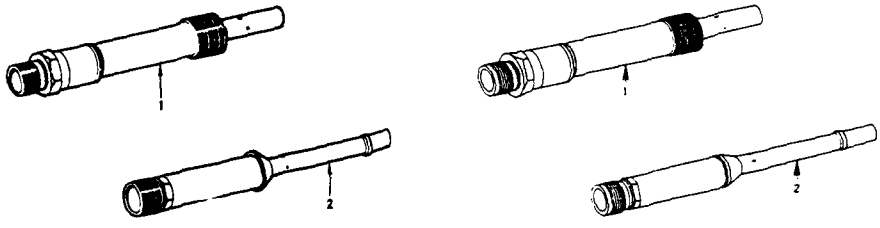
The initial set of CALS technical standards (Phase-I) included MIL-STD-1840A, MIL-D-28000, and MIL-M-28001. At the semi-annual CALS conference earlier this year in Gaithersburg, MD, attendees received the CALS Phase I.1 core requirements package including MIL-HDBK-CALS, MIL-D-CGM, MIL-R-RASTER, and extensions to MIL-STD-1840A and MIL-D-28000 with a request for review. Publication of the next revised standard is expected by December, 1988.

MIL-STD-1840A had originally been developed in coordination with industry by the Technology Information Systems (TIS) program at the Lawrence Livermore National Laboratory (LLNL), with **SYSCON** Corporation as the industrial contractor. The draft specification was subsequently transferred to the **National Bureau of Standards** for review and became, in due time, the first standard leading towards interoperability of DoD publications and engineering data.[17]

For example, one of the tests involved two documents (file sets) prepared by Pratt and Whitney. The files sets were delivered on magnetic tape to the ATOS (Automated Technical Ordering System) laboratory facility at SYSCON Corporation, San Diego, California. Each file consisted of a declaration file, SGML (Standard Graphics Markup Language) tagged text files, IGES illustration files, and raster image in CCITT group 4 format written on magnetic tape in accordance with FIPS PUB 75 and the MIL-STD-1840A Standard. The illustration below shows the image as originally published and as recreated by standard electronic digital means. Differences give rise to improvements and revisions of the standard.

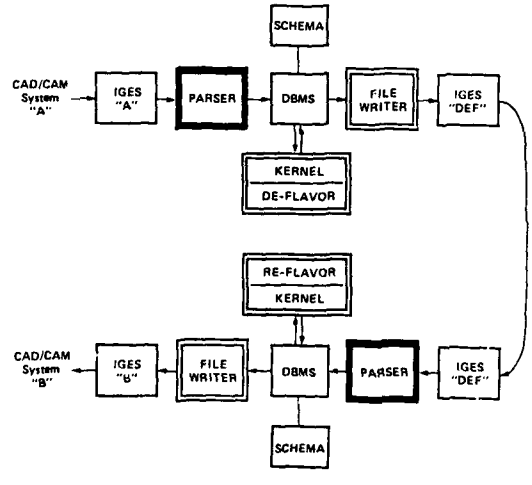
Series of tests are underway by the LLNL/TIS Program to evaluate the practicality and cost-effectiveness of the CALS standard for automated interchange and interoperability of technical information among different computer-aided design (CAD) equipments, and for progressively more difficult data sets of text, tables, schematics, and engineering drawings. The objectives of the tests is to demonstrate the validity of the transfer protocol defined in the standard itself and the viability of the standardized formats for the transfer of technical information defined in other specifications used in the Standard.[18]

Spark Ignitor as used on Pratt & Whitney F100 Aircraft Engines



As published **As transmitted & processed**

The task of establishing interaction between industrial and defense databases is even more difficult when engineering data is transferred between two dissimilar CAD (Computer Aided Design) workstations with their vendor-specific conventions and capabilities. The basic procedure consists of a parser to facilitate traversal of the IGES file into a common Database Management System (DBMS). The file writer then produces the inverse of the parser software and creates the IGES Data Exchange Format (DEF). During this process, it is essential to retain, to whatever extent possible, the preferred symbolics and nomenclature of individual IGES representations, also referred to as "flavors." This takes place in the static "kernel" modules for database access, and their corresponding dynamic converter modules which restructure the specific flavor of an IGES file to the neutral data exchange format, and vice versa.[19]



The volume of data for major weapon systems in electronic form is immense. For example, The B-1B is estimated to require **45,000 Gbits** of data to describe the airplane alone without its propulsion plants and electronics. Huffman compression techniques may reduce this to about 5,000 Gbits or about 600 Gbytes of data. Utilizing the forthcoming Optical Disk 6800 high-density data stores from Kodak, with a capacity of 1,020 GB on 150 14-inch disks, we note that both the B-1B test data, and its engineering data, could be stored on one 150-disk optical Kodak juke-box.

The delivery of large volumes of data over available long-haul communication channels is not practical today. Even a T1-link, at 1.5 Mbits/sec, would require at least 926 hours for all the B-1B compressed data, assuming ideal uninterrupted transmission without overhead burden. Delivery of weapon engineering data on non-erasable optical disk is therefore much preferred. However, to protect the integrity and security of the delivered data in compact form from inadvertent or covert abuse, is difficult. If not protected during transition and storage, we may find that electronic theft of weapon engineering data may increase in magnitude, not unlike what is reported by the banking industry where the average $500 physical holdup of banks has escalated to an average $500,000 electronic theft (of reported cases). Public-key encryption and authentication, described in Section 3.5, is one means for protecting the concentrated CALS engineering data.

Future gateways are practical tools for Information Engineering (IE)

Future developments point to networks of gateway processors capable not only of interconnectivity and interoperability, but also of transaction processing, modeling, encryption and decryption of resources, risk analysis and monitoring. Significantly, gateways lend themselves in conjunction with optical disk storage devices for the creation of an organization's electronic knowledgebase, or encyclopedia, patterned after principles of **Information Engineering (IE)**. New members of an organization, users, developers, system analysts and programmers will thus benefit from their collective and individual know-how. In short, we anticipate to compile the documentation for standards, procedures, configuration management, user accreditions, and transaction controls both as raster images, and as ASCII files, for interactive use with selective authorizations and views. This knowledgebase would give rise to the creation of transaction parameters and binary filters for gateway functions.

Expert knowledge systems have become practical and are being explored by DTIC to improve the man-machine user interface. Skillfully applied, practical **Artificial Intelligence (AI)** techniques can imbue also those less familiar with computer operations with a higher level of computer literacy and performance. Several AI hardware systems and the **PILOT** Executive Information System (EIS) software, are being applied and adapted to different prototype projects at the **DAITC Decision Support Laboratory.[20]** The primary concept is well expressed by the notion that, if potentially valuable information cannot be accessed in a useful way, the information may as well not exist ! This leads to EIS features of "exception reporting" where executives concern themselves primarily with problem areas highlighted on the screen in tabular or graphical form to signify deviation from stipulated norms. The causes of noted exceptions can then be explored with "drill down" features where executives with touch screens or pointers can progressively unfold lower levels of supporting information.

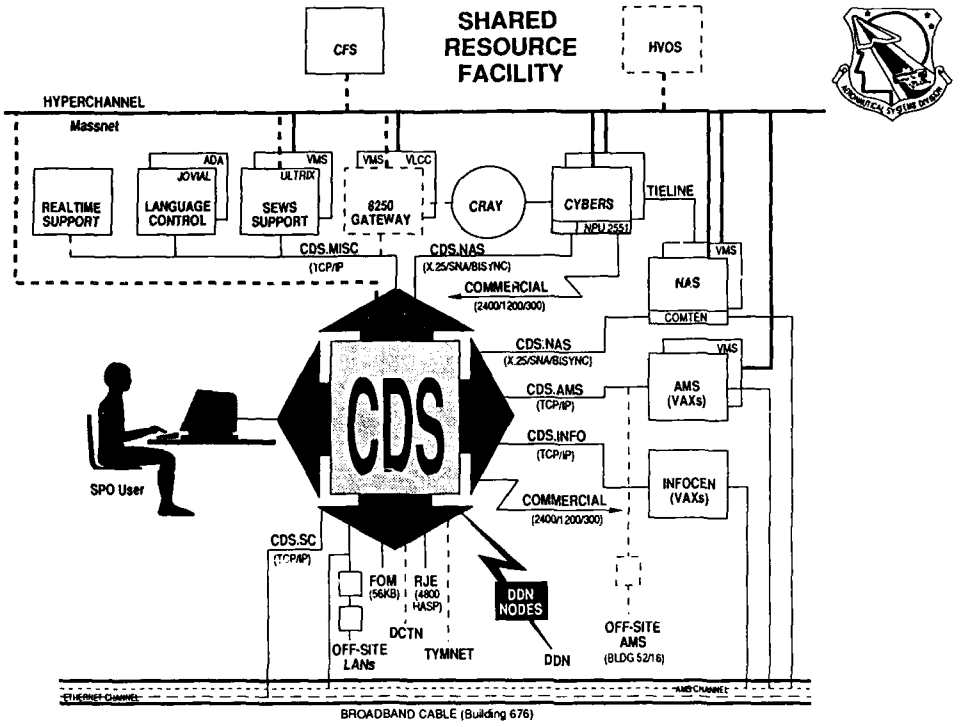
Transfer of Gateway Technology to industry.

Mandated by Congress to accelerate technology transfer from Government to industry, the IGP software was licensed to industry to provide a supported software for the benefit of the government and industry. The license is unique in that in provides for the return of enhancements by the licensee to the government, as recently lauded in a GAO report.**[21]** **Control Data Corporation (CDC)**, the licensee, enhanced the IGP software and is marketing it under the tradename **ASCENT.**

This Government-to-industry technology transfer has been successful. For example, when the Air Force Logistics Command (AFLC) needed to justify expansion of their Gateway Technology prototyped at Hill AFB to other depots, it tasked Martin Marietta's Data Systems (MMDS) to review the state of the art in the spring of 1987. The final review report was delivered after a seven-month intensive study by 21 system analysts from MMDS who interacted with 13 major hardware/software vendors (Amdahl, CCA, CDC, Cipher Link Anadata, DEC, ELXSI, Gould, IBM, Interactive Solutions Automator, Pyramid, Sun, Tandem, and Tolerant). The MMDS report states:

> "MMDS determined that the only available product other than the Intelligent Gateway Processor (IGP) R&D Government software, which addressed the AFLC/LOGDIS problem, was offered by Control Data Corporation (CDC) and marketed as ASCENT...
>
> Because ASCENT is the only software available that can perform the LOGDIS connectivity, menuing, and electronic mail functions, all of our solutions are based, at least in part, on this product."

This resulted in an expansion of the UNIX-based Defense Gateway system to all AFLC depots. Today, all AFLC depots are being equipped with gateways that provide **interoperabilty** in an otherwise hostile heterogeneous computer environment. Moreover, **Control Data Corporation (CDC)** subsequently won, in competition with other vendors, the award for the fault-tolerant "Central Datacomm System (CDS)" issued by the Air Force Systems Command (AFSC) at Wright-Patterson AFB. The CDS interconnects several major computers from different vendors, and different communication networks, for 1,500 simultaneous users. The initial configuration consisted of two **Pyramid 98x** dual proessor cessor gateways and six **Tolerant** machines. This created a successful interoperable information network for engineers, contract officers, and managers:



2.0 *Productivity Enhancement through Information Robotics*

The near-term payoff of the DoD modernization effort is expected to come with **robotics of information resource management (IRM)!** Most information systems today are still running "open loop" and information presented on the monitor screen must be interpreted by the human mind after each retrieval. Where the automation of tedious IRM procedures has been tried, it has yielded unprecedented savings in time and cost. The results of two robotic prototype systems illustrate this powerful approach: the **User Support System (USS)** of the Air Force Logistics Command (AFLC) in operation since 1985, and the **Intelligent Network Processor (INP)** slated to become the new automated transaction controller for military and civilian personnel in the government.

The AFLC User Support System (USS)

We have tested innovative, automated IRM procedures that substantially increase human productivity of item managers for spare parts at Hill Air Force Base, Utah, and Wright-Patterson AFB, Ohio. In a prototype operation by the Air Force Logistics Command (AFLC) from 1985-1987 and now undergoing full deployment, the automation with the *Intelligent Gateway Processor* (IGP) software increased the productivity by a factor of 2.6 for general purpose stock control and distribution procedures, and by a factor of 4.6 for the release of back orders. Typing errors were substantially reduced, thus alleviating the tedious subsequent need to correct the integrity of databases. These savings in time and work quality were established by human factors engineers observing the work of 24 item managers before and after the introduction of the gateway technology. The most dramatic savings were noted in the automated generation of the Overage Work Orders Reports which previously required a week and can now be carried out in less than one hour![22]

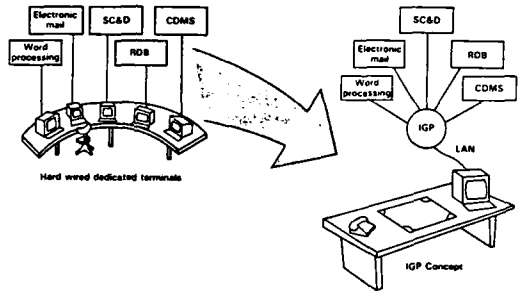
The automation scripts for some of the tasks were installed and tested within three days because of their table-driven implementation. Here, the Defense Gateway technology provided not only interconnectivity among dissimilar computers on base, but also established interoperability among heterogeneous information resources in a unifying manner, combining the daily tasks of:

1. Procurement mail and general correspondence
2. Access to computer systems for retrieval of data
3. Collection and compiling of information and data
4. Data manipulation and presentation
5. Word processing and filing
6. Reporting on spreadsheets and graphing
7. Access to ADP and OA hosts and equipment

To appreciate the magnitude of the automated User Support System (USS), formerly known as the Logistics Data Integration System (LOGDIS), bear in mind that the mission of AFLC depots is to keep the US Air Force's weapon systems in a state of constant combat readiness worldwide. The AFLC accomplishes this mission through a number of primary logistics functions of procurement, materiel management, distribution, and the maintenance of aircraft, spare parts and provisions. This logistics support is provided for all US Air Force organizations, other military services, and for allied countries. The AFLC has more than 500 logistics management information systems. These systems are used to support the tracking of $116 billion in assets and approximately 460,000 contracts, the handling of over 900,000 different supply items, maintenance of more than 9,000 aircraft in the US active inventory, and the management of over 100,000 military personnel and civilians. (These assets would rank the AFLC as the 27th largest corporation among the Fortune 500 companies). Most of these information systems were designed 20 years ago for a batch processing environment and are now being replaced by state-of-the-art technology. This effort is part of a major AFLC Logistics Management System (LMS) modernization program under Major General James Hopp, Commander of the Logistics Management Systems Center, and Mr. Samuel Greenwood, Assistant to the Commander.[23]

The Intelligent Gateway Processor (IGP) software was initially installed on a PYRAMID 98X UNIX-based prototype at Hill AFB to access information resources on dated islands of information, driven by vendor-dependent host computers with mostly incompatible operating systems:

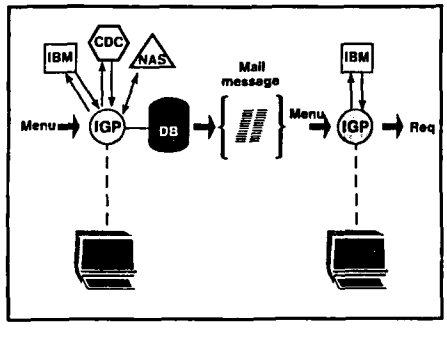
NAS3K/AS5K	TSO
IBM-3083	TSO
IBM-4341	VM
NAS3K/AS5K	CICS
D.G.MV-10,000	AOS/VS
Cyber-730	NOS
VAX-11/780	VMS
PDP-11/70	UNIX



Since the logistics data on these computers had to be used jointly, the data were carried from one machine to the other on magnetic tapes in three shifts, daily, as input for the item managers' status reports and summary statements, which previously had been prepared by hand on paper. These reports were then manually keyboarded for transmittal to other Air Force computers throughout the world and were used for procurement of spares. AFLC administrators and item managers who required access to these isolated databases worked with up to **five different terminals on their desks**. Each night, planes carried a load of magnetic tapes from depot to depot as backup in case of emergency or local unavailability.

This situation made a cumbersome work environment. Item managers had to learn and remember different log-on and retrieval procedures, manually transcribe the retrieved information, compile it on paper, and reenter the results on differently styled keyboards as input to other hosts. Errors, where they were not immediately noticed, could linger for days or weeks before being corrected. Those item managers who did not have their own set of terminals had to wait in line to query the different databases on the different host computers containing partial stock control data. The resulting wait times, the learning of peculiarities, differences in operating systems, incompatible database management systems (SYSTEM-2000, INGRES, UNIFY, CICS, PROFS, etc.), command languages, formats, and layouts of keyboards, all increased execution time and the probability of human error. This interoperability diminished work quality.

AFLC LOGDIS prototype
Logistics Data Integration Systems



- **IGP for automated stock control and distribution**
- **Uses interactive UNIX scripts to drive NAM scripts**
- **Automatically extracts data from different DBMS's**
- **Recorded productivity increases**

With the Defense Gateway installation, item managers can now work with different host computers from one terminal connected to a Pyramid minicomputer by following one self-prompting menu designed to meet their needs and wishes. At first, item managers identify the stock item number from an online database on the Gateway. A request for a global status report activates the Gateway scripts that automatically access each AFLC host computer, containing some part of the total information, in its peculiar way and issues the request for information, often as input for a batch process on the outdated machines. When the USS Gateway establishes that the work has been done, it downloads the results from each machine and compiles a summary report from their different output formats in one common INGRES database. Then the Gateway generates the comprehensive status report and delivers it as an annotated electronic mail message to the item manager. In other words, the Pyramid Gateway has a "user" account of its own on its operating system and sends the results of its accomplished work to its master, the item manager(s).

The item managers may have been working in the meantime on some other tasks on the Gateway. The IGP terminal's audible message alert prompts them to view the message containing the results of a previous request. Item managers can then decide the next course of action. They immediately can forward the message with comments to the requesting agency anywhere in the world, transparently with the IGP's Network Access Machine (NAM) utility, or save it as a record in their electronic file on the Gateway. If spare parts are missing, item managers may continue with the menu and have the Gateway establish from yet another distant host, which contains production schedules, how long it may take to deliver the missing parts. The requisition is automatically prepared by the USS Gateway, viewed, verified, and modified on the terminal screen as necessary, and signed off by the item manager(s). It can then be printed on a high-resolution laser output device looking exactly like the accustomed **government forms** that vendors expect to receive by mail; if they are not equipped to receive purchase orders electronically.

The successful prototyping of the User Support System (USS) prompted the AFLC to consider deployment of the Defense Gateway technology throughout other depots. Today, all AFLC depots are being equipped with gateways that provide unified management to information resources in a heterogeneous-host networking environment.

The Intelligent Network Processor (INP) technology for IRM automation

The Intelligent Network Processor (INP) technology is a new Defense Gateway technology capable of increasing the efficiency of any organization by giving the computer an active role in the management of its information resources. The INP network can be programmed to optimize the schedules and to monitor the execution of corporate transactions, initiate reports, and keep the review and approval of requests for action on time.[24]

We created this capability by encapsulating the behavior of an organization in decision and authorization tables. These INP tables can be extended in response to the changing demands of a corporate mission. Modeling the routine and on-demand behavior of an organization by computer is a new development process to improve management and productivity. We defined the organizational behavior as being represented by those procedures, rules, actions, and interfaces that are needed to accomplish the desired tasks, objectives, and goals of the mission. Behaviors may take place within a single component or involve several organizations.[25]

The INP concept and automation have been under development and test at the Air Force Military Personnel Center (AFMPC) at Randolph AFB, in Texas, since 1985 to modernize the Personnel Data System (PDS). This $152 million program, called Personnel Concept III (PC-III), will use the INP technology to reduce personnel office staffing by over 1500 people throughout the Air Force. In addition to the military personnel system, the closely related civilian personnel system, or Personnel Data System Civilian (PDS-C), is used by over 100 Federal agencies for the administration of the civilian work force in the government. This eliminates the development and maintenance of redundant personnel systems in these agencies and is saving about $100 million each year.

PC-III is one of the Reagan administration's presidential priority programs. It will substantially reduce redundant data entry for the 600,000 active-duty Air Force personnel. When fully installed by 1992 at over 126 Air Force bases, it will eliminate the processing of about 8 million pieces of paper annually. INP gateway technology thus provides a practical transition to a paperless society.[26]

Traditional information systems oblige the user to learn and remember all the processes and interactions that are going on among different organizations to accomplish specific tasks. In PC-III, we are pioneering a new approach for Information Resource Management (IRM) where the patterns of behavior of an organization are deposited in decision tables of intelligent processors in a computer network.

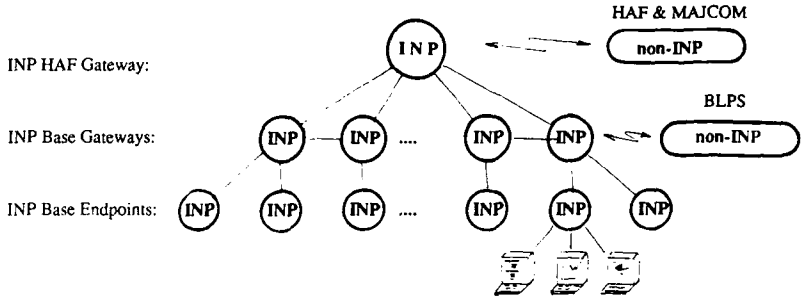
The PC-III-INP implementation integrates, therefore, the highly successful table-driven data processing techniques of the AFMPC-PDS with the table-driven, interpreter-based Intelligent Gateway Processor (IGP) software, developed at the Lawrence Livermore National Laboratory (LLNL). This is a considerable challenge in view of the 24 million lines of code in the current PDS which represent a significant investment in mission-critical support to the Air Force personnel management. Although written for military and civilian personnel management, the INP software contains generic capabilities that, when applied, will improve productivity of IRM operations in any organization.

The effects of the INP are analogous to project management tools that schedule interacting tasks in support of objectives required to reach a goal. Project management tools produce excellent and detailed charts depicting the timetables for actions and their critical paths. However, they usually require **visual** interpretation and **manual** supervision to translate the computer-generated printouts and deadlines into corresponding work assignments. The INP approach reduces these project management functions to the level of human activity by automating, where practical, and by monitoring the predetermined and on-demand work assignments.

Exploiting the capabilities of INP technology, Air Force personnel analysts have dramatically increased the productivity and efficiency of military personnel offices. This was achieved by rethinking entire personnel procedures and by transferring tasks previously carried out by enlisted personnel to a network of INP computers. This brings about considerable cost savings, bearing in mind that military personnel have to be trained **repeatedly** whereas computers will remember, given the instructions **once**.

Likewise, under PC-III, **the clerk enters the data only once** on a terminal in the orderly room. The data is then electronically transmitted and coordinated with work centers in the same organization or at other organizations. The INP system ensures that the updates are sent to all organizations with a need to know. The AFMPC Personnel Data System (PDS) network is structured in three layers to support all levels of military personnel management. When completed, the PC-III network will interconnect some 2,500 computers and over 10,000 workstations and terminals. For this network, we are developing two types of basic INPs, Gateways and Endpoints, with the following relationship:

1. Headquarters Air Force	HAF
2. Major Air Command	MAJCOM
3. Base Level Personnel System	BLPS



The INP technology does not require recompilation of programs to port functional software (behaviors) to different machines. This is a revolutionary step in the development and use of computer technology to improve the efficiency and productivity of software development. Those familiar with software engineering will appreciate that INP makes use of software encapsulation, data hiding, inheritance, transparent software configuration management, and other advanced concepts.

The INP technology provides an alternate approach for the design and development of Information Resource Management (IRM) systems by making it possible to implement simultaneously the software for the system and the applications. In contrast, the porting of applications developed with procedural languages to computers with different hardware, even when the programming language and operating system are the same, requires the recompilation and reloading of software, which usually interrupts service. INP technology offers a non-intrusive method for execution of functions on heterogeneous computers.

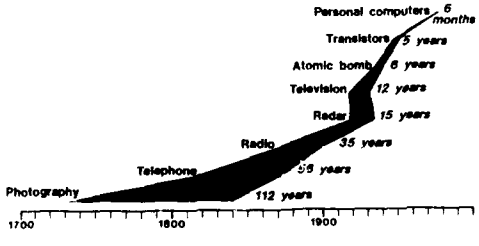
In fact, this INP methodology was first applied by AFMPC to the design and implementation of the INP software itself. It has boosted the number of lines of code written per day by system analysts and programmers from the industry's average of 7-10 to more than 70 lines per day, per person. This resulted in the on-time start of the most important PC-III milestone: an operational test under actual operating conditions at Moody AFB to confirm the anticipated 1500 manpower savings.

Today, large staffs are still needed to manage the information flow in complex corporate structures. Tomorrow, computers employing INP technology could be relegated the chore to sort out what is important based on changing priorities and organizational capabilities, and to orchestrate the completion of tasks in an optimal manner. Computer scientists developing theories and implementation strategies for the sharing of resources on geographically distributed information networks have made significant contributions to the state-of-the-art. The INP technology introduces a practical means by which these contributions can be brought to reality for the difficult task of establishing a viable means for Information Resource Management (IRM) of an organization.[27]

3.0 Tools for the Extraction of Intelligence and Enhanced Decisionmaking.

The challenge of the late 1980s is to integrate the dissimilar information stores into coherent information networks for improved decisionmaking in a rapidly changing global work environment. At the root of this rapid evolution is a universal competition which drives us to shorten the time delay between discovery and application of technical innovations. It took 112 years for photography to move from the laboratory to the popular box cameras, but only 5 years for transistors to replace vacuum tubes. Today, new makes of personal computers are being marketed within six months of their conceptualization and design. The desire to be first in technological achievement is the primary motivation among professionals, industries, and nations.

The universal search for information, is driven by economic and technological competition. The resultant econometric competition is potentially devastating. Here, the United States is vulnerable. Public access to information is essential to our democratic way of life, yet we face a dilemma: how to develop more efficient information resources and decisionmaking tools for the wellbeing of our country while, at the same time, protecting sensitive data from exploitation. The health records of our nation are readily accessible. We cannot be remiss to be first in their effective use![28]



Working with meta databases in science and technology.

The retrieval and analysis of textual and bibliographic information has been described earlier with the DGIS SearchMaestro and PROCESS routines. Here we discuss the need for the analysis of annotated numeric data, or meta data, as an urgent requirement in the daily information gathering activities of the interdisciplinary programs in the defense community. Project-oriented information systems and company-proprietary analysis tools are inadequate for general applications. It is no longer possible to access all needed information from a single database or, with the help of experts, in one field of specialty. Needed is the replacement of application-specific tools by a generic system independent of electronic hardware and software constraints.

Successful attempts to solve this problem can be found in chemical information systems developed for chemical research. These systems provide not only relevant bibliographies but contains also tools for the compilation and analysis of numeric and factual data from the large online meta databases: CAS ONLINE from STN International, INDEX CHEMICUS ONLINE produced by the Institute for Scientific Information, the Kirk OTHMER Encyclopedia of Chemical Technology available on DIALOG and BRS, to name a few. A variety of chemical software packages have also become available to chemical researchers for chemical structure modeling, scientific word processing, prediction of structure-activity relationships, analysis and tracking of new synthetic pathways and for the determination of chemical structures based on spectroscopic and analytical data.[29-41]

The full utilization of newly engineered substances, like high-temperature ceramics, semiconductors, composites, and the new crop of superconductors, could well benefit from gateway systems that can provide the communication highways to these distributed information resources, and to **Chemical Information Management Systems (CIMS)** for creative analysis and synthesis.

MACCS	-	Molecular Design Limited, San Leandro, California
DATACCS	-	Molecular Design Limited, San Leandro, California
DARC	-	Telesystemes Questel, Paris, France
CENTRUM	-	Polygen Corporation, Waltham, Massachusetts
STN	-	Chemical Abstract Service, Columbus, Ohio

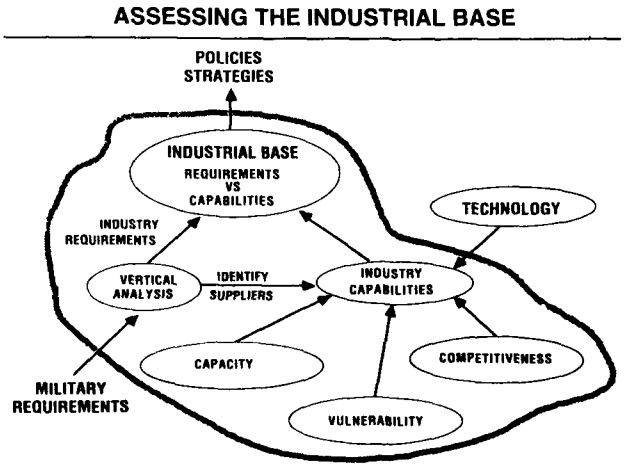
Of these, MACCS and DATACCS have been used by major chemical and pharmaceutical companies in the United States, Europe and Japan since 1980; DARC usage in-house is found in many industries in Europe and Japan. The availability of CENTRUM was announced in March 1987, and the Scientific and Technical Network (STN) International database system is being extended to include the **Material Properties Data (MPD) system**, in conjunction with Japan and West Germany. The Defense Gateway Information System (DGIS) at the DAITC is being considered as a test site for the installation of the competing and complementary CIMS tools in support of scientists, engineers, and decisionmakers in the defense community.[42]

Utilization of national socioeconomic databases.

One of the most ambitious projects under development at the DAITC is the **Defense Industrial Network (DINET)** which requires the combined analysis of large volumes of socioeconomic and numeric national databases with textual descriptive information, meta attributes, and large volumes of numeric tabular data. It started in 1987 when the DoD Under Secretary for Acquisition, Dr. Robert Costello, proposed a comprehensive effort to improve the U.S. defense industrial base.[43]

Among the proposals associated with this project is the establishment of a **Defense Policy Innovation Center** to receive, evaluate, and test new ideas for improvement of the DoD acquisition and manufacturing programs. The proposal reflects views and suggestions made by industry spokesmen and independent experts on ways to make the United States more competitive in certain manufacturing sectors important to the national security. For example, the United States increasingly relies on European and Japanese machine tools and electronic manufacturing equipment. The resulting DINET objectives are:

- o policy on industrial strategic planning
- o defense-oriented analysis of technological data
- o more efficient ways of developing and producing weapon systems

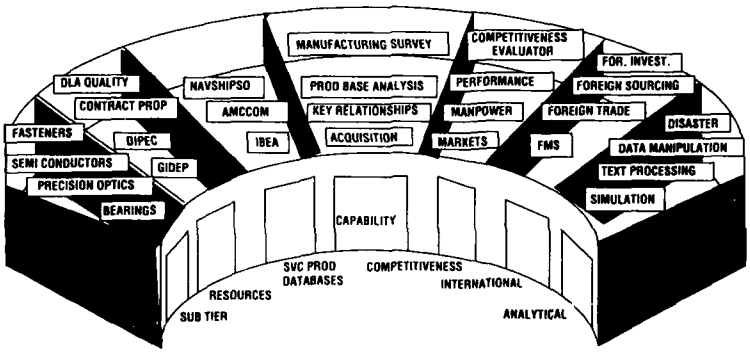


The DAITC staff is exploring for the DINET project the applicability of now available techniques for the evaluation of existing DoD, civilian, and commercial databases to better analyze the viability of the domestic industrial base. This work has shed some insight on the ability of U.S. industry to provide assemblies, parts and components for major weapon systems during peacetime, surge, and mobilization.

The DINET program should help decisionmakers who are asking how much materiel can be produced, and how quickly, in times of peace and emergency. It is necessary to know where the constraints are on increased production and options for alleviating those constraints, thus increasing the capabilities of the industrial base.

A key issue often expressed in the public media is the concern over reliance on foreign suppliers and the capacity of lower tier contractors supplying more than one weapon system. Lessons learned from these studies have been helpful in identifying alternate sources. Such information not only provides a clearer perspective of the domestic industrial base, but serves also as an incentive to increase competition and lower acquisition costs. DINET is expected to track aggregate industrial trends on plant capacity and financial strength of contractor firms. This will include NATO and foreign production and requirements data to appraise NATO impact on the U.S. industrial base.

GETTING TO THE DATA



No single database can give a complete answer to every question, but the use of the **Defense Gateway Information System (DGIS)** during the last year has demonstrated that **it is possible** to establish an information network which can access, retrieve, compile, and track significant industrial base activities over time. The previously described DGIS SearchMAESTRO automated access and retrieval programs for bibliographic citations, and the DAITC Gould HyperSearch firmware and software for the analysis of large volumes of text and data, are being used for the DINET program with considerable success. The correlation of database attributes among the different databases is well underway at the **DAITC Decision Support Laboratory** with Expert Knowledge Systems like the Xerox 1186 Artificial Intelligence workstations, the Texas Instruments Explorer LX, and the Symbolics 3670 processor and display system.

Still needed are the Common Command Language for the manipulation of the large number of diverse databases, and a flexible translator of database-specific output into neutral data exchange formats for the compilation of the dissimilar textual and numeric extracts. Although these tools are under development by the DTIC, the universe and complexity of databases required by the DINET program poses a new challenge for their application. Data analysis programs with statistical, graphical, and pattern recognition techniques are also required and underscore the importance of interoperability. The gateway technology, capable of integrating different commercial and federal application programs as they become available, serves therefore an essential role. The DINET program clearly demands better interaction and utilization of databases in government, defense, and industry.[44]

Exploration of foreign market databases

The U.S. Army analyzes foreign defense markets to take advantage of foreign material and technology when they offer cost savings over domestic research, development, and acquisitions programs, and when increased effectiveness is expected in fielding equipment that is interoperable among allied forces. Market analysis activities are categorized as either market surveillance or market investigation.

The U.S. Army's current system for collecting and analyzing market information does not fully utilize available organizational resources, nor does it make effective use of new data sources and information technologies that could enhance the system. For example, market analysis currently is limited to accessible databases. In recognition of these limitations, the Logistics Management Institute (LMI) has been tasked by the Army Material Command's Office for International Cooperative Programs (AMCICP-M) to implement a prototype system that will, with the selective use of automation, help streamline these activities. This prototype is named the Foreign Market Analysis System (FMAS).

LMI has chosen to integrate two proven systems as the foundation for the first FMAS prototype rather than to develop new software: the **International Decision Support System (IDSS)** and the **Defense Gateway Information System (DGIS)**. IDSS has been developed on behalf of the Office of the Secretary of Defense by the Institute for Defense Analyses (IDA) to support the managers and action officers involved in interoperability. The IDSS, modified to meet the foreign market analysis requirements, and when combined with the DGIS database access and downloading capabilities, is expected to become a valuable tool for the analysis of foreign markets.

In Europe, the Commission of the European Communities, Directorate General XIII, Information Market and Innovation, has played a significant role in the development of online information retrieval. To provide improved and less expensive data communications, the Commission sponsored **Euronet**, an international packet switching network created by a consortium of European countries. Following the creation of the network, the Commission also sponsored and encouraged the creation of **Direct Information Access Network for Europe (DIANE)**, through which information services connected to Euronet could present a common service. Within the framework of Euronet and DIANE, the Commission has sponsored and encouraged a number of developments.

With assistance from the EEC, Infotap SA and Geonet Systems created the **Intelligent Information Facility (II-Facility)** which is a gateway. The European Commission Host Organization (ECHO) has been able to make available 15 databases via the II-Facility gateway. From these databases, the FMAS project is most interested in exploring access to the following:

- **DIANEGUIDE** contains about 800 databases with detailed information on database producers, databases and host services available on DIANE.
- **European Abstracts' (EABS)** databases cover a wide range of subject areas and contain references to the published results of scientific and research programs wholly or partially sponsored by the CEC.
- **Tenders Electronic Daily (TEDS)** is the online version of the S-Supplement of the Official Journal of the European Communities and contains public calls for tender offered by more than 80 countries.

The goal is to create a user-friendly IDSS interface to DGIS which can take care of data retrieval, downloading, and uploading of files. Initially, the interface will be demonstrated between IDSS and a domestic database such as ***Aerospace, Defense Markets & Technology (Predicasts)*** or *DMS/Online (DMS)* which are both available via DIALOG. Ultimately, this would develop into network access with the II-Facility of ECHO, sponsored by the CEC. This in turn will lead to a demonstration of the IDSS-DGIS interface using European database(s) of interest to the foreign market analysis community. This is a difficult task and will challenge the combined resources of the **DAITC Defense Gateway Information System (DGIS).[45]**

4.0 Multimedia Data Storage and High-speed Communications.

Despite the gains in computerization, 95 percent of the corporate and governmental information still exists on paper. For example, the Navy is estimated to have 30 million pages of technical manuals on ship maintenance and repair. The average office worker hoards some 18,000 pages of information on paper and saves them in at least one four-drawer filing cabinet that costs some $522 to maintain annually. And, while office executives spend more than three hours each week looking for misfiled information, clerical staff spend even more time searching.**[46,47]**

There is new hope. Optical, high-density data storage systems offer unprecedented opportunities for storing paper records on a CD-ROM database for use at the PC workstation and/or connected to a departmental computer. Here we distinguish raster data storage for the archiving of images of correspondence, historical records, maps, pictures, etc., and computer-readable ASCII files. Ideally, both storage modes should be available for viewing and searching/retrieving the full-text document, respectively.

The High-Density Information Systems (HDIS) Laboratory at the DAITC is a focal point for prototyping these new technologies. The lab and its equipment is a much needed link between defense organizations interested in learning how high-density information technology can assist them, and vendors anxious in gaining exposure for their products. The following turnkey optical-disk document storage and retrieval systems are installed for exploratory use:

FILENET	Centralized optical disk system
ACCTEX System	Departmentalized optical disk system
DISCUS 1000	Small optical disk system
PLEXUS XDP95	Supermicro-based optical disk system (Palantir)

For PC usage, the CD-ROM 5.25-inch disk is capable of storing enormous data volumes and can be read from a Phillips or Hitachi reader with the following equivalents for a one-sided disk:

550,000,000	characters of digital data
200,000	pages of typed text
64,000	compressed video still images
1,500	floppy diskettes
72	minutes of audio or video
32	20-Mbyte Winchester hard-disk drives
16	file cabinet drawers

But, these high-density data storage systems are doomed to become yet more costly islands of automation unless they are made accessible over high-speed communications by fiber-optics and/or satellite links. When this takes place, it will usher in total integration of voice, data, graphics, images and interactive video conferencing and training, with immense savings in costs.

Several projects at the DAITC are under way to explore the suitability of optical disk data storage and full-text search/retrieval techniques with CD-ROMs for the huge data files of the:

- o Defense Mapping Agency (DMA)
- o Federal Supply Catalogue
- o Federal Acquisitions Regulations (FAR)
- o Federal Voting Assistance Task Force
- o Federal Legal Information Through Electronics (FLITE)

For the Air Force C-17 advanced transport plane we are moving raster images of contracts and engineering drawings from the San Diego McDonnell Douglas plant to the 108 AFLC contract officers at WPAFB by electronic mail. And, for the Air Force Logistics Command (AFLC), we have explored the integration of voice and ASCII messages.

Storing 20 magnetic tapes of DMA data on one 5.25" CD-ROM.

For the Defense Mapping Agency (DMA), the DAITC has been tasked to establish a DoD standard for data storage on optical media to replace the bulky magnetic tapes now used. As a result, the DAITC High Density Information System Laboratory (HDISL) developed several DMA databases on CD-ROM in coordination with DMA data users, including:

- o Mapping, Charting, and Geodetic (MC&G)
- o Digital Terrain Elevation Database (DTED)
- o ARC Digitized Raster Graphics (ADRG)
- o Digital Features Analysis Data (DFAD)

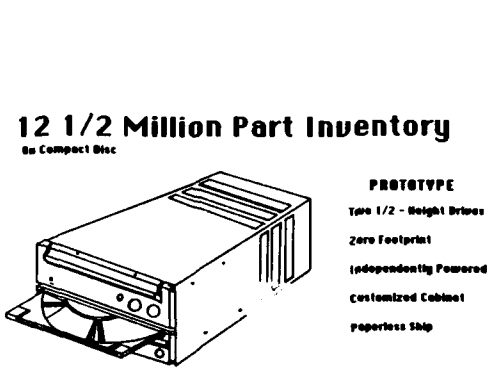
DMA is distributing these CD-ROM prototype databases for test and evaluation to their users, in particular the U.S. Army Engineering Topographic Labs, Naval Oceanographic Research and Development Activity, and the U.S. Air Force Tactical Air Command.

The DAITC is helping DMA to evaluate these prototypes. Many benefits are expected from using CD-ROM. DMA will be able to cut costs considerably since 10-20 magnetic tapes' worth of DMA data can fit on one CD-ROM. This will save money on storage as well as shipping costs. For example, it costs approximately $40.00 to mail 20 magnetic tapes, compared to $0.73 for the corresponding CD-ROM disk. DMA will also be able to produce and distribute information more quickly because of the mass replication process possible for CD-ROMs. Finally, DMA will be able to service a whole new group of users because CD-ROMs can be easily used on a microcomputer.

Besides helping to evaluate the prototype CD-ROMs, the DAITC is adapting these CD-ROMs to non-IBM microcomputers and minicomputers. Another challenge is to help DMA develop software interfaces and procedures that programmers could readily incorporate in their specific application programs with DMA's CD-ROMs.

Compacting 1,725 microfiche of the federal supply catalog on two CD-ROMs.

The Defense Logistics Service Center (DLSC) is supporting DoD agencies by disseminating logistics data of the 13-million parts Federal Supply Catalog to 29,000 users in the defense community on 1,725 microfiche of 269 pages each. The catalog can also be interrogated by telephone dialup to an online system.



DLSC decided to explore the use of CD-ROMs as a more cost-effective way for distributing their Federal Supply Catalog database and tasked the DAITC to develop a CD-ROM prototype retrieval system. All the data could be stored on two CD-ROMs. This system will help cut costs in many ways. Shipping costs will be lower because the two CD-ROMs are much cheaper to ship than the heavy microfiche. Productivity will increase as users take advantage of a fully automated, PC-based search and retrieval system. Another benefit will be shorter training classes.

The prototype CD-ROM system requires the daisy-chaining of at least two CD-ROM drives connected to an IBM PC-compatible computer. The Navy added the requirement for the drives to have a "zero" footprint to meet limited space requirements on ships and submarines. The DAITC High-Density Information Systems Laboratory helped DLSC to define the specifications for this type of a new CD-ROM drive and found a manufacturer that designed and delivered within a few weeks a drive consisting of two half height CD-ROM drives in one small enclosure just 6 inches wide. The drive can rest next to the monitor on top of the PC-computer, thus having a "de facto zero" footprint. Other vendors followed with their own 2-drive compatible models.

The DAITC is also assisting DLSC in the development of the technical specifications to be included in a future Request for Proposal (RFP) that DLSC plans to issue for large-scale productions of their CD-ROM application. This task involves a study of computers and operating systems on which the CD-ROMs could be used, the in-house requirements for optical equipment at DLSC, and the selection and enhancement of the software for retrieval, indexing, formatting, and specific applications.

In addition to DLSC's databases, the DAITC is also incorporating other logistics data on prototype CD-ROMs. Currently, each military service maintains its own service-specific logistics database but has agreed to supply their service-specific formats to DLSC to establish a single, integrated logistics system that will eliminate redundancy and cut costs.

Optical disk storage of the FAR, DFAR, and FLITE databases.

There has been a continuing requirement by the DoD procurement community for an online, concurrent search capabilities and on-demand printing of the following lengthy documents and their many revisions and updates:

- o Federal Acquisition Regulation (FAR)
- o Defense Federal Acquisition Regulations Supplements (DFARs)
- o Federal Acquisition Circular (FACs)
- o Defense Acquisition Circular (DACs)
- o Federal Legal Information Through Electronics (FLITE)

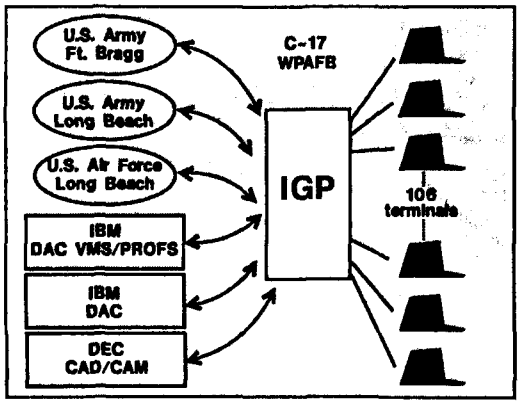
This has been accomplished on a Defense Gateway with a Gould 6050 computer and HyperSearch as the retrieval software. Fortunately, the original text was available in computer-readable form. It could thus be readily stored on disk, compressed, and encoded. The HyperSearch program created the vocabulary tables to the knowledgebase and has been used for exploratory online searching from local and remote terminals.

A similar development is underway for the creation of online access to the Federal Legal Information Through Electronics (FLITE) textual database that is part of the Defense Emergency Authorities Retrieval and Analysis System (DEARAS). This program will require online retrieval capabilities similar to those of the FARs and DARs, in addition to CD-ROMs and their use in portable laptop computers by legal staff in times of emergency. All of these developments make use of high-technology hardware and software that has been available only recently.

The C-17 information system of the Army, Air Force, & Douglas Aircraft Corp.

The first direct interaction between a DoD Special Project Office (SPO) and the contractor's project and engineering databases was initiated in October, 1986, and is now a showcase of successful interaction between defense and aerospace information systems. It is the **Management Information System (MIS) for the C-17 cargo airlifter** and involves the Army, Air Force, and Douglas Aircraft Corporation (DAC) in San Diego, California. The MIS Gateway of the Air Force Systems Command (AFSC) is located at Wright-Patterson AFB where the IGP software is installed on a PYRAMID-98X gateway. The C-17 MIS links the different SPOs and contractor offices throughout the country.

AFSC C-17 Information System



- **IGP provides access to industrial DBMS's**
- **EM links C-17 SPO to prime contractor**
- **Retrieves data for local use**
- **EM/FAX for signed documents**

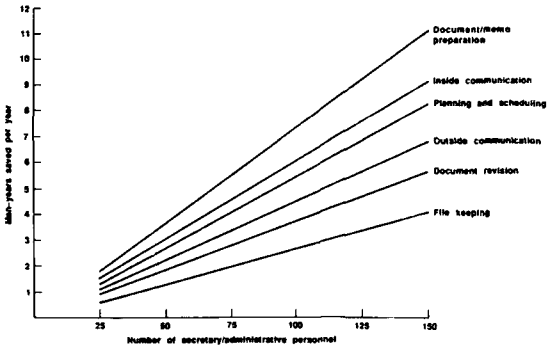
The C-17 MIS, reaching operational status in February, 1988, was in step with the **"formulas for action"** outlined in the **Packard Commission's report on acquisition reform**: The C-17 MIS is the primary source of program data to provide detailed visibility into current status of the program. The data and the reporting formats are selected to realize the maximum benefit from information collecting procedures by putting it immediately into usable form. The AFSC SPO required the **"Total Information Engagement"** concept requiring free flow of project information between the Air Force and the prime contractor. This included access to the prime contractor's MIS, exchange of electronic mail with the prime contractor, online access to the prime contractor's logistics database, online access to the C-17 contract, electronic transmittal of signed documents, and communications capability with the Department of Defense. (C-17 Cargo Airlifter SPO, Air Force Systems Command, ASD/AFWAR 55318).

The IGP Gateway provided the interconnectivity between the heterogeneous computers (IBM and DEC machines at DAC, and NAS, DEC, and CDC machines at WPAFB). The IGP Electronic Mail (EM) system was extended to transmit and display facsimile drawings on workstations. This includes a transparent linkage between the IBM/PROFS and the PYRAMID-98X/IGP, and from the latter to the Defense Data Network (DDN) and to other commercial and federal carriers worldwide. (IBM/PROFS electronic mail normally can communicate only with other IBM machines.) The C-17 Program has been recognized by the U.S. Senate as a model acquisition effort. Letters of commendations were issued by the AFSC and LLNL to Control Data Corporation and its staff for their excellent professional work in the pilot project under contract to LLNL/TIS.

Integration of voice, data, and video.

In 1977 the TIS program inaugurated voice delivery of ASCII electronic mail to any touch-tone phone, or rotary-dial phone with hand-held tone generator. At that time, the VOTRAX voice generator from American Screw Company and the Bell Telephone ASCII-to-Voice synthesizer software were used. While it was a somewhat cumbersome arrangement in the late 1970s, as the TIS/IGP Gateway was equipped with only one dial-in port for users to access, interrogate, and listen to their electronic mail from any telephone instrument, it proved the capability of ASCII-to-voice translation.**[48]**

During 1975-1977 we evaluated 64 **SYDIS [49,50]** UNIX-based workstations that permitted simultaneously voice messaging and ASCII electronic mail. They also permitted the digitized voice annotation within the ASCII text of an electronic mail messages. The icon of a small loudspeaker would blink on the terminal screen to indicate the voice annotation. Placing the cursor on the spot would play the voice message. Human factors engineers did an extensive study on this **Integrated Voice/Data System (IVDS)** installation at WPAFB and found an overall productivity gain of 13 percent in time saved, which translated into about $400,000 per year for the test community.



Optical disk storage of CALS weapon engineering data

For the **CALS program**, we envision voice annotation of engineering drawings, and overlaid markups in color as a practical method of storing engineering data and their commentary on optical disks. It would be excellent for requesting revisions to an engineering drawing or document. In preparation of multi-media interactive work, we are exploring **"earcons,"** or **structured audio messages**, issued by the PC to reenforce the ongoing visual computer action on the terminal's screen. We prepared guidelines for the syntactic design of audio cues in computer interfaces, and investigated alternative integrated voice/data systems for the Air Force Logistics Command. We have been working on optical character recognition from digitized raster images of text and are exploring total integration of human communications by adding interactive video capabilities. These innovations promise to substantially increase the productivity, flexibility, and extendibility of the defense logistics. However, they also increase the potential vulnerability from inadvertent corruption of the data or covert abuse.**[51-55]**

Optical storage devices from different vendors permit the indexed deposition of correspondence, reports, maps, images in raster form, and their retrieval with keywords from local, hard-wired workstations in about 5-15 seconds. The read-out speed is limited to about 328 Kbytes/sec. (The most advanced system announced by KODAK, Optical Disk 6800, claims a capacity of 1020 Gbytes on 150 14-inch disks and readout speeds approaching the nominal speed of the Ethernet LANs, or 10 Mbits/second.)

Optical character readers are being tested for their reliability of translating existing raster-image texts into corresponding ASCII files, without redundant keyboarding, for high-speed searching by their information content. The accuracy varies with the complexity and fidelity of the image. The DAITC has been experimenting with **Kurzweil** and **Palantir readers** where automated translation capabilities reach, under ideal conditions, the desired 95% accuracy of translation above which the process becomes cost-effective.

Optical fiber communications are coming on the market with transmission speeds of **more than 1 Gbit/sec** per channel. This makes it attractive to interconnect high-resolution workstations with distant mass storage systems, like the recently announced Write-Once Read-Many times (WORM) jukeboxes. This would make it possible to store large volumes of CALS data and modify them as needed. Although the weakness of the prevalent optical disk technology that does not permit erasure of the data becomes the virtue for the CALS program as it can be used to provide an unambiguous audit trail. Public-key encryption offers authentication of electronic data files and has been endorsed by the X.509 ISO/CCITT committee for international communications. This should be of particular interest to vendors and defense contract officers who would wish to ascertain that the delivered electronic engineering data accurately describes the procured object.

CONCLUSION

Future scientific and technological information networks of the NATO countries must necessarily encompass the knowledge base of the world. They must also strive to overcome linguistic barriers to unlock the wealth of worldwide information to scientists and engineers in the United States, our allies, and members of NATO. The needed highways to global information centers are being built by the Defense Technical Information Center (DTIC) with gateways containing comprehensive annotated directories, translation tables, and tools for the downloading, analysis, and controlled sharing of text and data.

Gateways are well suited for the task of translating dissimilar and incompatible resources until standards are accepted and installed. Search techniques other than Boolean logic are being developed with Expert Knowledge systems to cope with the volume and diversity of scientific material, and to recognize the decisive discoveries from the continuing avalanche of publications.

The modernization programs further direct our Military Departments to receive the engineering drawings of future weapon systems entirely in electronic form: assembly and maintenance manuals and engineering data for advanced product definition. The resulting concentrated electronic databases must be kept authenticated and secure as they are shared over public communication channels with different levels of sensitivity and classification.

To prepare for the future, the Defense Technical Information Center is training a new generation of interdisciplinary knowledge workers as partners of the research and engineering teams for DoD programs. New tools for information management and electronic documentation are being introduced. Powerful capabilities are being developed for the rapid prototyping and demonstration of information robotics which lead, in turn, to more powerful executive decision support systems. This is an exciting challenge.

Today's information technology exceeds our expectations of yesterday !

EPILOGUE

Successful management of the large information stores in the 1980s has been an immense and complex task for governments, their defense organizations and industries. It necessarily encompasses worldwide logistics and all human endeavor now that international transport is commonplace and satellite communications are starting to span geographic and continental divides.

The challenge of the 1990s will be to make sense from the wealth of data and to extract understanding, knowledge, and wisdom how best to cope with the global problems of social unrest, disease, pollution, atmospheric heating, drought, and famine. The population prophets have been forgotten, but 80 million mouths to feed are added this year to our 5.32-billion strong humanity which will nearly double and reach 10 billion by the year 2010.[56]

The inevitable global upheaval is already being felt in the developing countries. Solutions to these problems transcend the threat of war between the superpowers and may bring forth a consciousness of global scale. The problems will undoubtedly be felt most in those countries that find it difficult to curb their population growth and do not have the technology, industrial base and organizational infrastructure for a determined satisfaction of their basic needs. Here, the most painful human dilemmas are not just disease and hunger, but the belief that industrialized countries withhold information from those anxious to learn how to improve their lot.[57] And those privileged that go to learn abroad are thought to become corrupted by Western ways and often do not return to their homeland that needs them most.[58]

Decisionmakers and information resource managers cannot disregard these realities. If the industrialized nations do not jointly begin to help the developing countries catch up with the exponential growth of technology, we may have to face an uprising of the masses in Africa, Asia, and the Americas that has little to do with communism or capitalism because it will be fueled by the deprived innate human thirst for knowledge.[59,60]

DISCLAIMER

REFERENCES

1. For further information on the CENDI Consortium, please contact any one of its members:
   Department of Commerce (DOC), Washington, D.C., Tel. (703) 487-4650.
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   Department of Defense (DoD), DTIC, Cameron Station, Alexandria, VA 22304.
   Department of Health and Human Services (HHS), NLM, Bethesda, MD 20894.
2. Cotter, G., The Scientific and Technical Information Network (STINET): Foundation for Evolution, DTIC/TR-88/5, AD-A189 750, September, 1985;
3. Defense Applied Information Technology Center, 1800 N. Beauregard Street, Alexandria, VA, 22311. TEL: (703) 998-4652, FAX: (703) 931-3968.
4. Technical Committee on Operating Systems of the IEEE Society, IEEE Trial Standard Portable Operating System for Computer Environments," IEEE Std 1003.1, Issued April, 1986.
5. Williams, M.E., Highlights of the Online Database Field - Gateways, Front Ends, and Intermediary Systems, National Online Meeting Proceedings. Learned Information, Inc., Medford, N.J., May, 1985.
6. V.E. Hampel, S.K. McGrogan, L.E. Gallo, and J.E. Swanson, The LLL "META-MACHINE" -- A Flexible, Extensible, and Practical Technique for Interactive Data Management, Modeling and Distributed Networking, Lawrence Livermore National Laboratory, Livermore, CA, UCRL-83064 (May 1979).
   V. E. Hampel, Carolyn Bailey, Richard A. Kawin, Neil A. Lann, Stephen K. McGrogan, Walter S. Scott, Soren M. Stammers, and John L. Thomas, "TIS" - An Intelligent Gateway Computer for Information and Modeling Networks, Overview, Lawrence Livermore National Laboratory, UCRL-53439, August, 1983.
   V. E. Hampel, Integration of Communications with the Intelligent Gateway Processor, Proceedings of the EPRI Seminar on Integrated Power Plant Communications, San Francisco, CA, UCRL-95277, August 25-27, 1986
   M. E. Berch, Implementation of the Intelligent Gateway Processor Using UNIX, Proceedings of the EPRI Seminar on Integrated Power Plant Communications, San Francisco, CA, UCRL-95241, August 25-27, 1986.
   V.E. Hampel, R. Barker, R. Kawin, N. Lann, S. McGrogan, N. Sharpe, T. Murphy and G. Winiger, TIS - The Intelligent Gateway Processor, Presented at the Eighteenth Annual Hawaii International Conference on System Sciences (University of Hawaii, January 2-4, 1985); also published by the Lawrence Livermore National Laboratory Livermore, CA as UCRL-91701 (October 1984).
   B.S. Lawyer, D.W. O'Brien, N.E. Poggio, Code Development with the EAGLES Engineering Problem Solving Environment, published by the Lawrence Livermore National Laboratory as UCID-20666, (February 1986).
   V.E. Hampel, J.B. Cain, R.A. Kawin, G. Pavel, N.A. Lann, G.T. Richards, and W. S. Scott, TIS-A Focal Point for Technology Transfer, Lawrence Livermore National Laboratory, Livermore, CA, UCRL-53343 (September 1982).
7. Cotter, G., Information Retrieval Systems Evolve - Advances for Easier and More Successful Use, in the Proceedings of the AGARD Conference on Barriers to Information Transfer and Approaches Toward their Reduction, AGARD-CPP-430, September, 1987. Refer also to:Cotter, G., The Scientific and Technical Information Network (STINET): Foundation for Evolution, DTIC/TR-88/5, AD-A189 750, September 1985.
8. For additional information on SearchMAESTRO, please contact Marjorie Powell, Defense Technical Information Center, DTIC-EB, Cameron Station, VA 22304-6145. (202)274-5367.
9. Jacobsen, C>E>, Jarus, J., Directory of DoD-Sponsored R&D Databases, DTIC/TR-88/1, AD-B116 400, February, 1988.
10. Mr. Kurt Molholm, Administrator of the Defense Technical Information Center (DTIC), has fostered good will and the acceptance of the DRIT (Defense Retrieval and Indexing Terminology) by members of NATO for the indexing of NATO publications in a unified and standard manner.
11. Software Bridge, is a software product of Systems Compatibility Corporation, 401 N. Wabash, Suite 600, Chicago, Illinois 60611. (312) 329-0700.
12. SYSTRAN, A Translating Service
13. TII Translation Services, A Division of Telecommunications Industries, Inc., 1951 Kidwell Drive, Vienna, VA 22180. (703) 790-0410.
14. Kuhn, A.D., Bixby, R.L., Tran, D.T., DoD Gateway Information System (DGIS) Common Command Language: The First Prototyping and the Decision for Artificial Intelligence, DTIC/TR-87-19, AD-A185 950, August, 1987.
    Tran, D.T., DoD Gateway Information System (DGIS), Common Command Language: PROLOG Knowledge Base Profile, DTIC/TR-87/23, AD-A186 150, October 1987.
    Bixby, R.L., DoD Gateway Information System (DGIS), Common Command Language Mapping, DTIC/TR-87-20, AD-A185 951, October, 1987.
    Kuhn, A.D.,Toward an Artificial Intelligence Environment for DTIC: Proposed Tasks, Recommended Configurations, Projected Start-up Costs, DTIC/TR-87-13, AD-A181 103, May, 1987.
15. Billingsley, R., and Burton, H., The DTIC/DGIS Bibliographic Post-Processor Software: PROCESS, Defense Technical Information Center, Bldg. # 5, Cameron Station, Alexandria, VA 22304.
    W.A. Bollinger, V.E. Hampel, I. Harrison, and T.P. Murphy, Post-Processing of Bibliographic Citations form DOE/RECON, NASA/RECON and DoD/DROLS, Presented to the Eighth International Online Information Meeting (London, England, December 4-6, 1984); also published by the Lawrence Livermore National Laboratory, Livermore, CA as UCRL-89995, Rev. 1 (August 1984).
16. MIL-STD-1840A, Copies may be obtained by writing to Dr. David Bettwy, Director of the CALS Support Office at the National Bureau of Standards, Gaithersburg, MD.
17. SYSCON Corporation, Contact: Albert S. Howe, (619) 296-0085.
18. Garner, B., Pratt and Whitney Technical Order Transfer Tests, UCRL-15935, AITI Report 87-002, June 12, 1987. This is a series of report for different tests.
19. Hampel, V.E., Garner, B.L., Matthews, J.R., Intelligent Gateway Processors as Integrators of CAD/CAM Networks, UCRL-93115, Proceedings of the American Society of Mechanical Engineers, Miami Beach, FL, November 21, 1985.
20. PILOT, Executive Software Inc., 40 Broerd Street, Boston, Mass., 02109.
21. Technology Transfer, Constraints Perceived by Federal Laboratory and Agency Officials, U.S. General Accounting Office (GAO), GAO/RCED-88-116BR, March, 1988.
    Francke, P., Grinstead, R., Energy Lab's UNIX Software Made Available to All, 1987.
22. Schultz, E.E., Abrahams, S., Banks, W.W. Jr., Prassinos, P.G., LOGDIS, Productivity Evaluation Report, UCID-21198, August 26, 1987.

23. Puttre, M., Air Force Systems Aim High, Information Week, p. 42, August 8, 1988.
24. Legg, J.R., Bernard, C.E., Hampel, V.E., INP - Intelligent Network Processor Technology, A New Approach to Increase the Productivity of Any Organization, Randolph AFB and Defense Applied Information Technology Center, refer also to proceedings of Human Resources Management and Organization Behavior 1988 Conference, Oct. 26029, 1988, June 1988.
25. Chorafas, D.N., Applying Expert Knowledge Systems in Business, McGraw Hill, 1987, p. 64.
26. McGraw, T., A Better Job of Managing Their People: Field Commanders rely on decentralized personnel system, PC III, Government Computer News, April 15, 1988.
27. Stone, J., Progress Needed for Federal Office Systems Programs, Federal Computer Week, p.15, May 30, 1988.
28. V.E. Hampel, Fact Retrieval for the 1980s, Proceedings of the Technical Information Panel (TIP), NATO/AGARD Conference (Munich, West Germany, AGARD-CCP-304, 1981); also published by the Lawrence Livermore National Laboratory, Livermore, CA as UCRL-85749 (July 1981).
29. Browett, W.R., Stillman, M.J., Computer-aided Chemistry. II. A Spectral Database Management Program for Use with Microcomputers, Comput. Chem. 11 (1) 73, 1987.
30. Helmar, W.P., Hug, G.L., Carmichael, I., Toss, A.B., Development and Use of Numeric Databases for Properties of metastable Chemical Species in Solution, J. Chem.Info.Comput.Sci. 26 (3) 99, 1986.
31. Morffew, A.J., Todd, S.J.P., Snelgrove, M.J., The Use of a Relational Database for Holding Molecule Data in a Molecular Graphics System, Comput. CHem. 7 (1) 9, 1983.
32. INTERACTIVE; Biodesign, 199 South Los Robles, Pasadena, CA 91101; (818) 793-0151.
33. INSIGHT, DISCOVER; Biosysm Technologies, 9605 Scranton Road, San DIego, CA 92121; (619) 458-9990.
34. ChemDraw: Cambridge Scientific Computing, P.O. Box 2123, Cambridge, MA 02238; (617) 491-6862.
35. Molecular Presentation Graphics; Hawk Scientific Systems, 170 Kinnelon Road, Kinnelon, NJ 07405; (201) 838-6292.
36. MICROCHEM; Lextek Scientific, 600 West Van Buren, Chicago, IL 60607; (312) 346-6163.
37. SYNLIB; Distributed Chemical Graphics.
38. PC Model; Serena Software, P.O. Box 3076, Bloomington, IN 47402; (812)333-0823.
39. *Chemintosh; SoftShell Co.*, 88 Fox Chapel Road, Henrietta, NY 14467; (716) 334-7150.
40. Institute for Scientific Information (Gary Schwartz, Director - ISI Software), 3501 Market Street, Philadelphia, PA 19104; (215) 386-0100.
41. COMPress, P.O.Box 102, Wentworth, NH 03282; (603)764-5831.
42. Hampel, V.E., Grubb, D.P., Moulik, A., Interactive Access to Scientific and Technological Factual Databases Worldwide, UCRL-97617, Proceedings of The Metallurgical Society, Cincinnati, OH, Meeting, October 12-14, 1987.
43. Costello, R.B., Bolstering Defense Industrial Competitiveness, Preserving our Heritage, the industrial base, securing our future, Report to the Secretary of Defense by the Under Secretary of Defense (Acquisition), July, 1988.
44. Morrison, D.C., Halting the Erosion, National Journal, July 30, 1988.
45. Billingsley, R., The Defense Technical Information Center and its Role in Foreign Scientific and Technical Information, Draft, Defense Technical Information Center, Cameron Station, Alexandria, VA 22304-6145.
46. Lambert, S., Ropiequet, S., The New Papyrus, The current and future state of the art., Microsoft Press, 1986.
47. Thiel, T.J., Weinman, L.S., Optical Memory Systems Development in a Defense Prototyping Environment, Defense Applied Information Technology System, High Density Information System, Optical Information Systems, March-April, 1988.
48. Hampel, V.E., et als., User's Manual for the Technology Information System, Lawrence Livermore National Laboratory, Livermore, CA 94550, M-0112, 1981.
49. The prototype vehicle, SYDIS, is now marketed by British Telecom under the name of Gandalf VoiceStation System.
50. Banks, W.W., Prassinos, P.G., Productivity Assessment of an Integrated Voice/Data Workstation, Lawrence Livermore National Laboratory, Livermore, CA 94550, UCID-21028, March 1987.
51. Sumikawa, D.A., Blattner, M.M., Greenberg, R.M., Earcons: Structured Audio Messages, Lawrence Livermore National Laboratory, Livermore, CA 94550, UCRL-94644, March, 1986.
52. Sumikawa, D.A., Blattner, M.M., Joy, K.I., Greenberg, R.M., Guidelines for the Syntactic Design of Audio Cues in Computer Interfaces, Lawrence Livermore National Laboratory, Livermore, CA 94550, UCRL-92925 Rev.1, May, 1986.
53. Prassinos, P.G., Kirton, S.E., An Investigation of Alternative Integrated Voice/Data Systems for the Air Force Logistics Command, Lawrence Livermore National Laboratory, Livermore, CA 94550, June 1987.
54. Blattner, M.M., Berch, M.C., Weldon, J.R., Multi-Media Mail, Technology Information Systems annual report in Computer Science Research, Computation Directorate, Lawrence Livermore National Laboratory, Livermore, CA 94550, 1986.
55. Key Technologies for the 1990s, an Overview of the Aerospace Technical Council of AIA, Aerospace Industries Association of America, Inc., 1250 Eye Street N.W., Washington, D.C. 20005, dated November 1987, first released August, 1988.
56. Personal communications with Offices at the World Bank and International Monetary Fund.
57. Bollinger, W.A., Ellingen, D.C., Evolving United States Information Policy and its Effect on International Access to Online Databases, Proceedings of the International Online Information Meeting, London, December, 1987.
58. Personal communications with the Institute for International Education (IIE), New York, NY.
59. Kennedy, P., The Rise and Fall of the Great Powers, Economic Change and Military Conflict from 1500 to 2000, Random House, 1987.
60. The Bible, The Epistle of James, Chapter 1, Verse 5.

THE ORGANISATION AND FUNCTIONS OF DOCUMENTATION AND INFORMATION CENTRES IN DEFENCE AND AEROSPACE ENVIRONMENTS

Technical Information Panel Specialists' Meeting
Athens, Greece, 19—20 October, 1988

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